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Bohl et al.

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(45) **Date of Patent: Oct. 20, 2015**

(54) **BLADELESS TURBINE**

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(73) Assignee: **SOLAR LOGIC INCORPORATED**, Muenster, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 337 days.

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(2), (4) Date: **May 10, 2013**

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PCT Pub. Date: **Jan. 5, 2012**

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(60) Provisional application No. 61/361,238, filed on Jul. 2, 2010, provisional application No. 61/361,266, filed on

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(51) **Int. Cl.**
B60K 16/00 (2006.01)
F01D 1/36 (2006.01)

(Continued)

(52) **U.S. Cl.**
CPC .. ***F01D 5/02*** (2013.01); ***F01D 1/34*** (2013.01); ***F03G 6/04*** (2013.01); ***F03G 6/065*** (2013.01); ***F03G 6/068*** (2013.01); *F05D 2220/75* (2013.01); *Y02E 10/46* (2013.01)

(58) **Field of Classification Search**
CPC F01D 5/02; F01D 1/34; F01D 2220/75; F03G 6/04; F03G 6/068; F03G 6/065; Y02E 10/46
USPC .... 60/641.8; 415/90; 416/181, 223 R
See application file for complete search history.

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Primary Examiner — Hoang Nguyen
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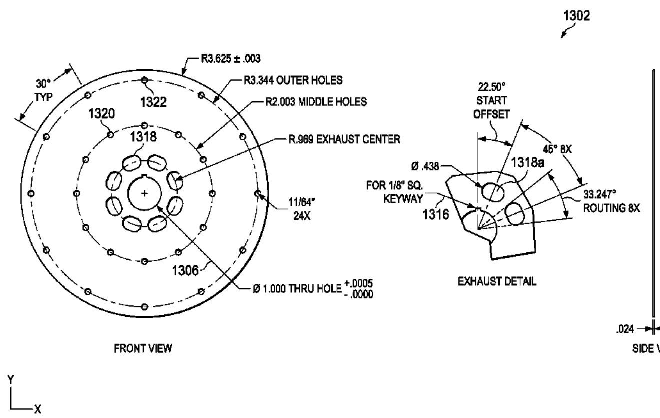
(57) **ABSTRACT**

The bladeless turbine includes a case, three or more turbine discs disposed within the case. Each turbine disc has a center opening, and two or more of the turbine discs have a set of exhaust ports positioned annularly around the center opening. A drive shaft passes through the center openings of the turbine discs and is attached to the three or more turbine discs, wherein the drive shaft is positioned within the case along the centerline, free to rotate within the case, and extends through the case for connection to a generator. The one or more fluid/vapor inlets are attached to the main housing such that a fluid/vapor is directed at a specified angle onto the three or more turbine discs. The fluid/vapor outlet is aligned with the centerline. A set of exhaust holes proximate to and connected to the fluid/vapor outlet that are positioned annularly around the drive shaft.

51 Claims, 16 Drawing Sheets



Related U.S. Application Data

Jul. 2, 2010, provisional application No. 61/361,251, filed on Jul. 2, 2010, provisional application No. 61/361,215, filed on Jul. 2, 2010, provisional application No. 61/243,154, filed on Sep. 16, 2009.

(51) **Int. Cl.**

F01D 5/02	(2006.01)
F01D 1/34	(2006.01)
F03G 6/06	(2006.01)
F03G 6/04	(2006.01)

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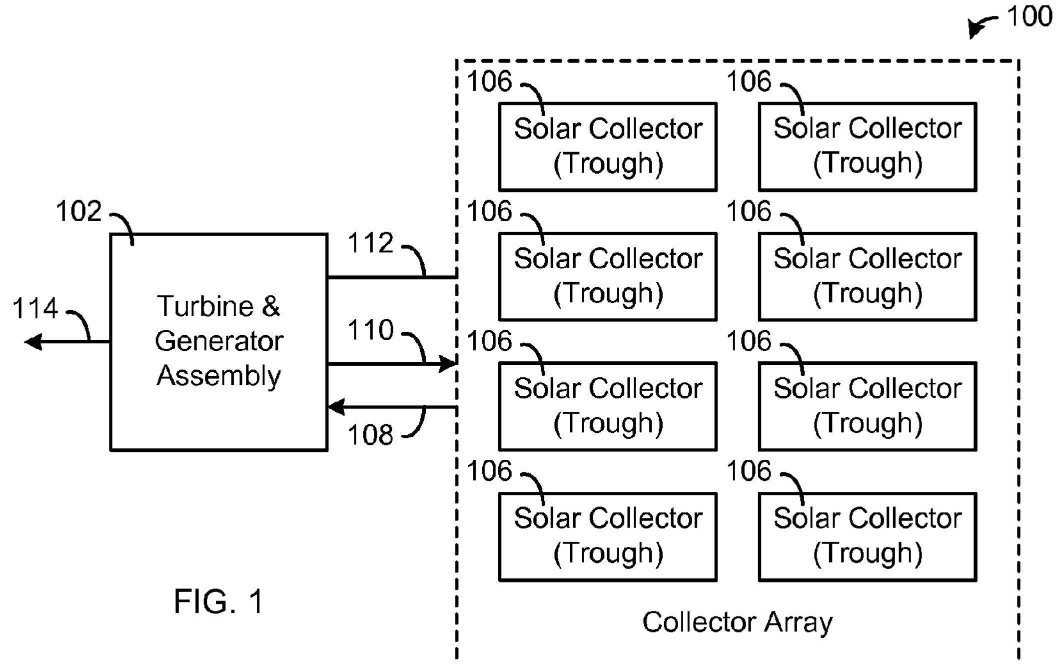

100
106
Solar Collector (Trough)
106
Solar Collector (Trough)
106
Solar Collector (Trough)
106
Solar Collector (Trough)
106
Solar Collector (Trough)
106
Solar Collector (Trough)
106
Solar Collector (Trough)
106
Solar Collector (Trough)
102
Turbine & Generator Assembly
112
110
108
114
Collector Array

FIG. 1

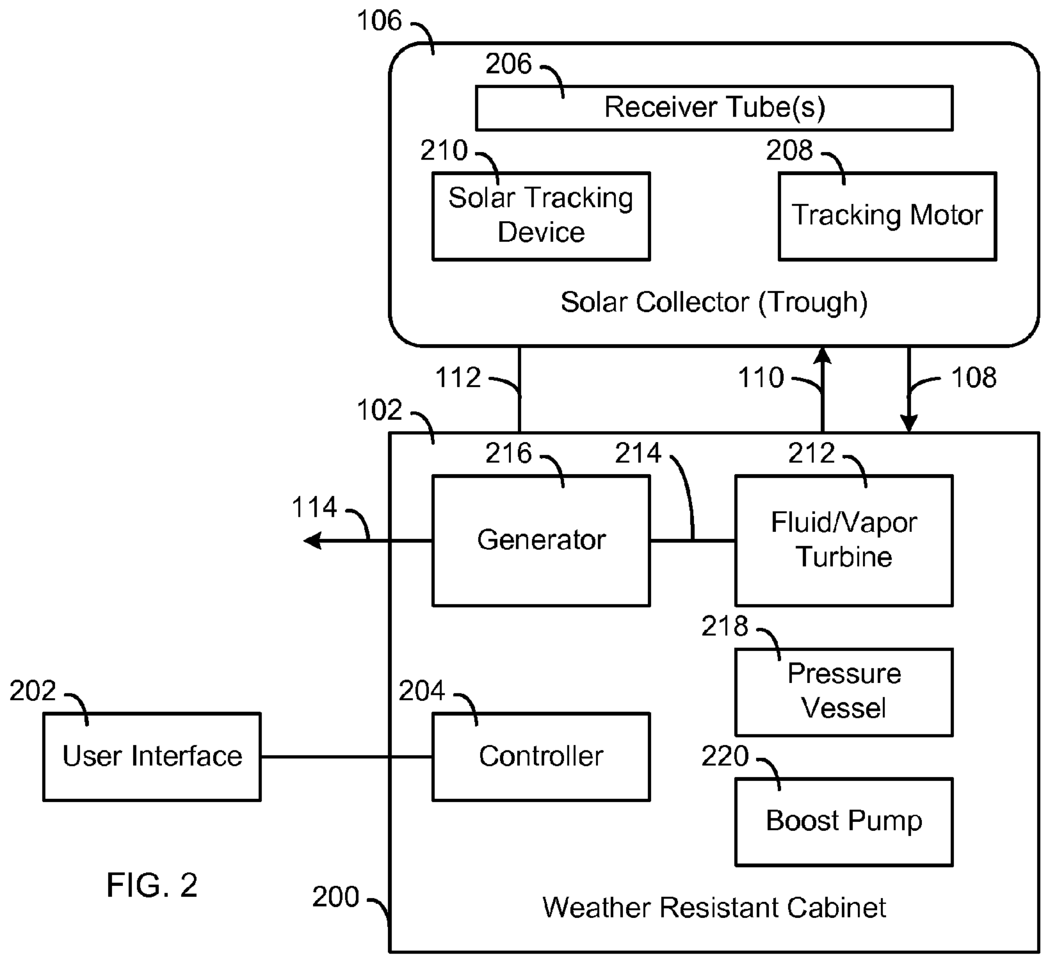

106
206
Receiver Tube(s)
210
Solar Tracking Device
208
Tracking Motor
Solar Collector (Trough)
112
110
108
102
216
214
212
114
Generator
Fluid/Vapor Turbine
218
Pressure Vessel
202
User Interface
204
Controller
220
Boost Pump
200
Weather Resistant Cabinet

FIG. 2

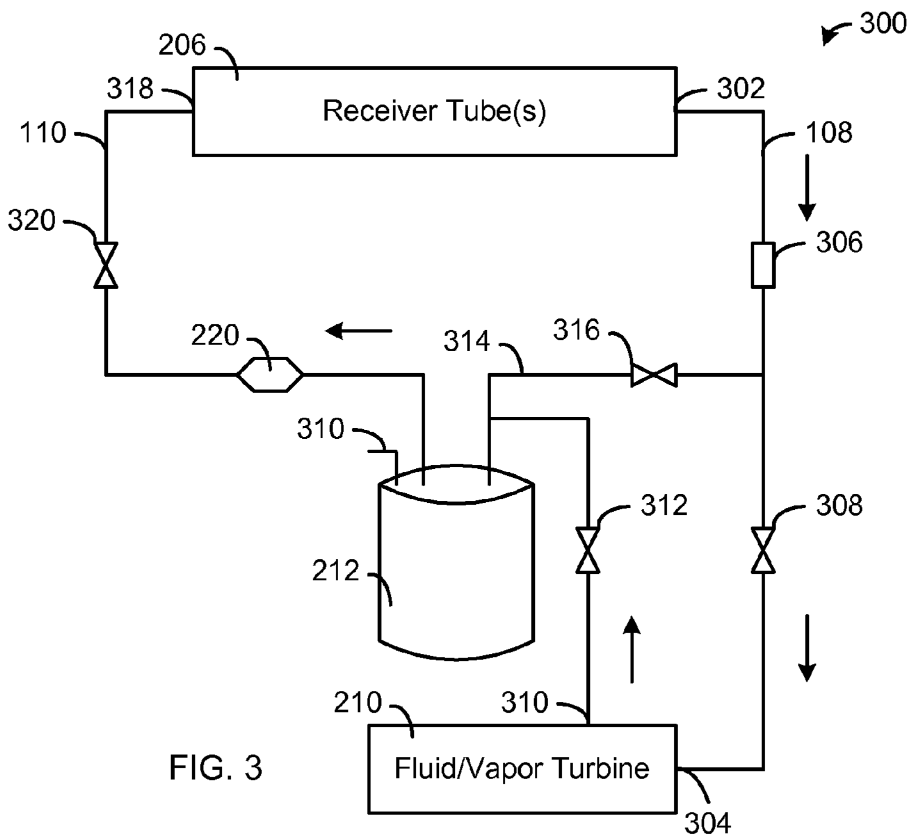

300
206
318
Receiver Tube(s)
302
110
108
320
306
220
314
316
310
312
308
212
210
310
Fluid/Vapor Turbine
304

FIG. 3

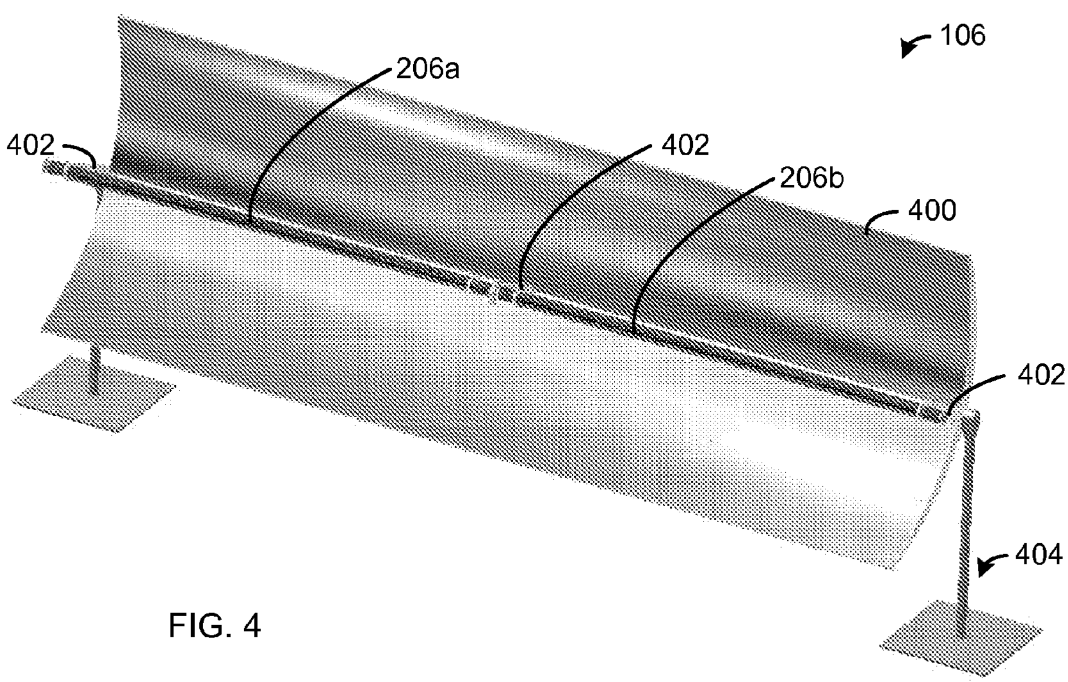

106
206a
402
402
206b
400
402
404

FIG. 4

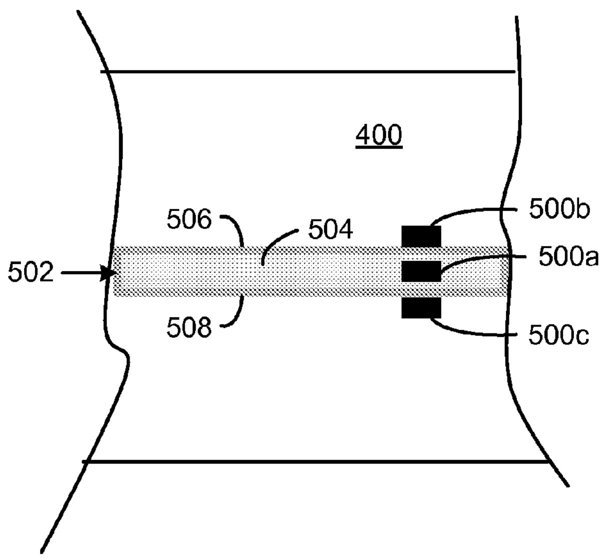


FIG. 5A

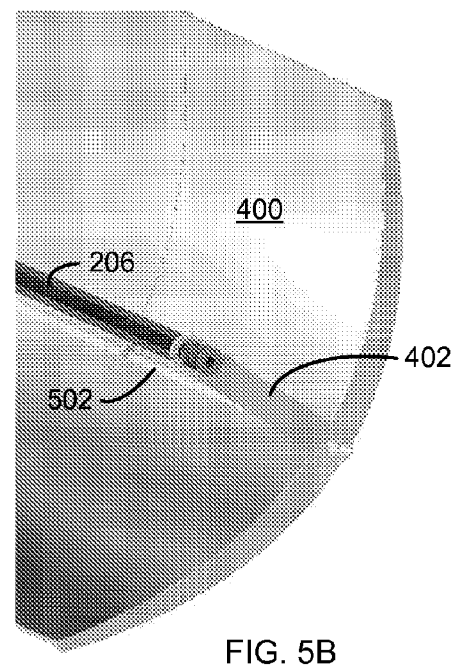


FIG. 5B

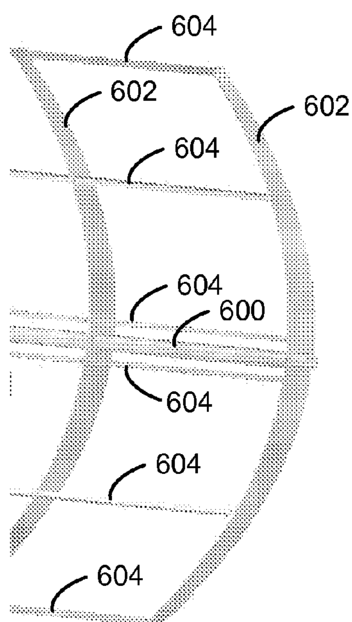


FIG. 6

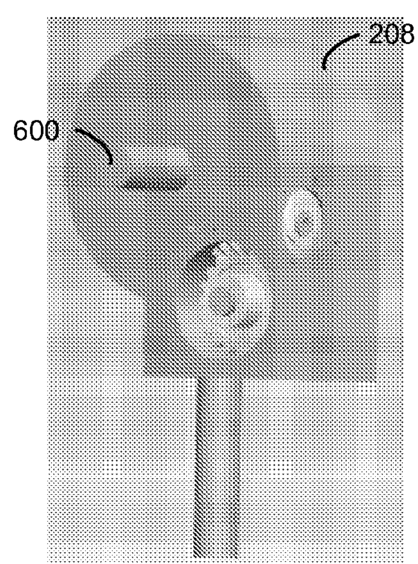


FIG. 7

FIG. 8A

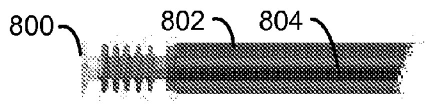


FIG. 8B

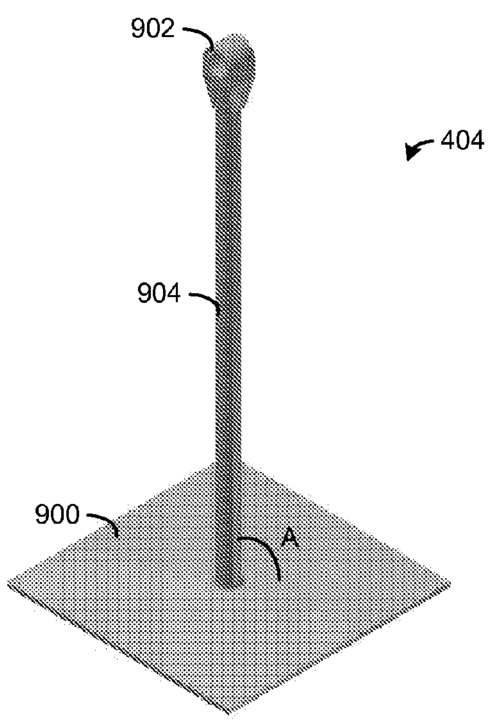


FIG. 9

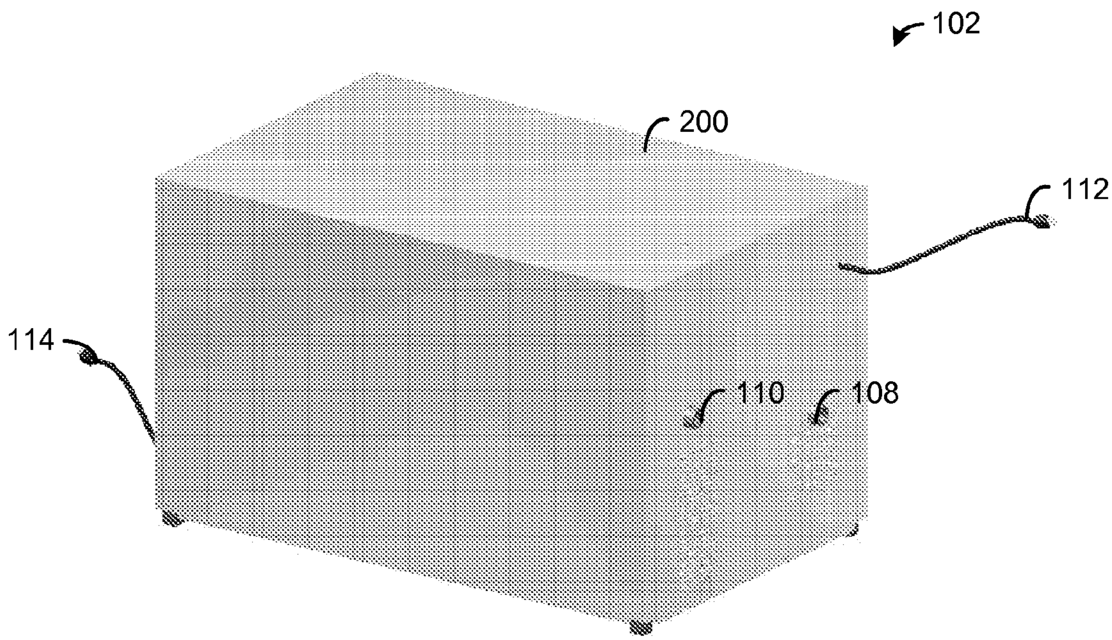


FIG. 10A

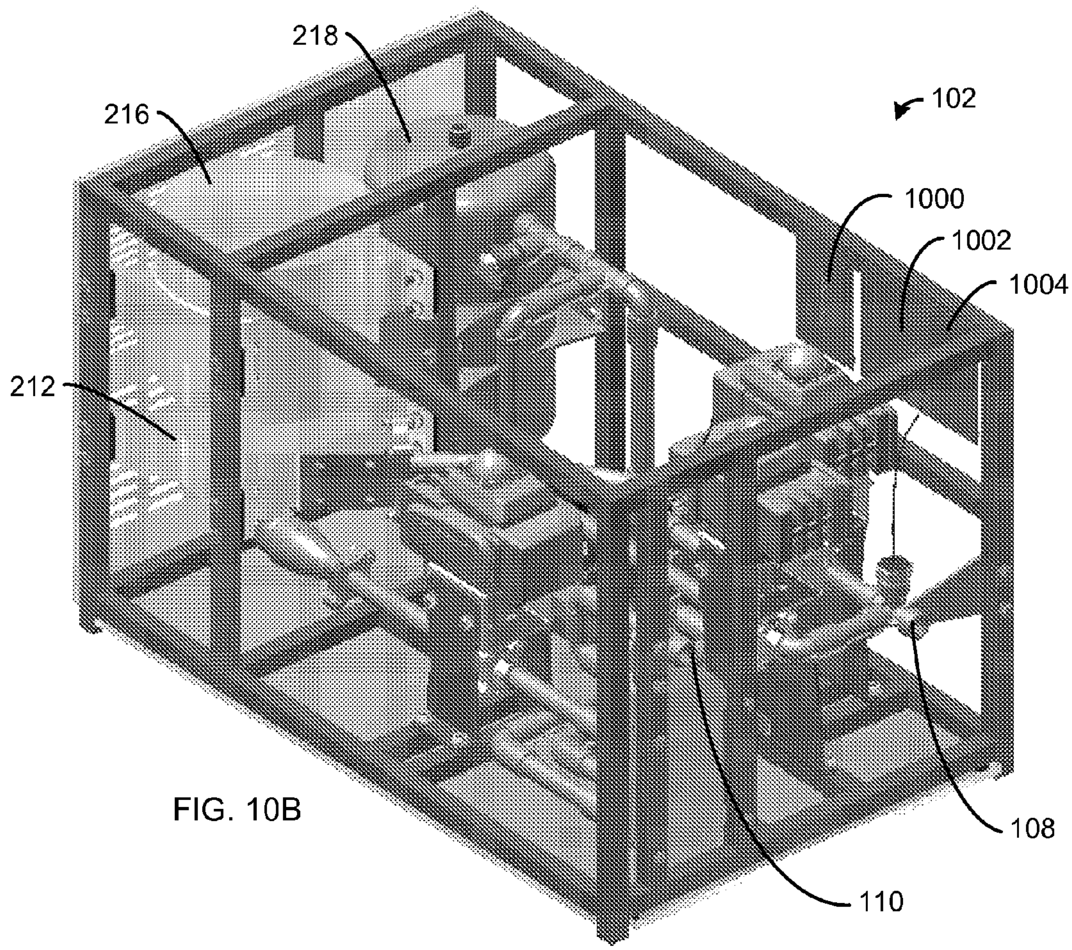


FIG. 10B

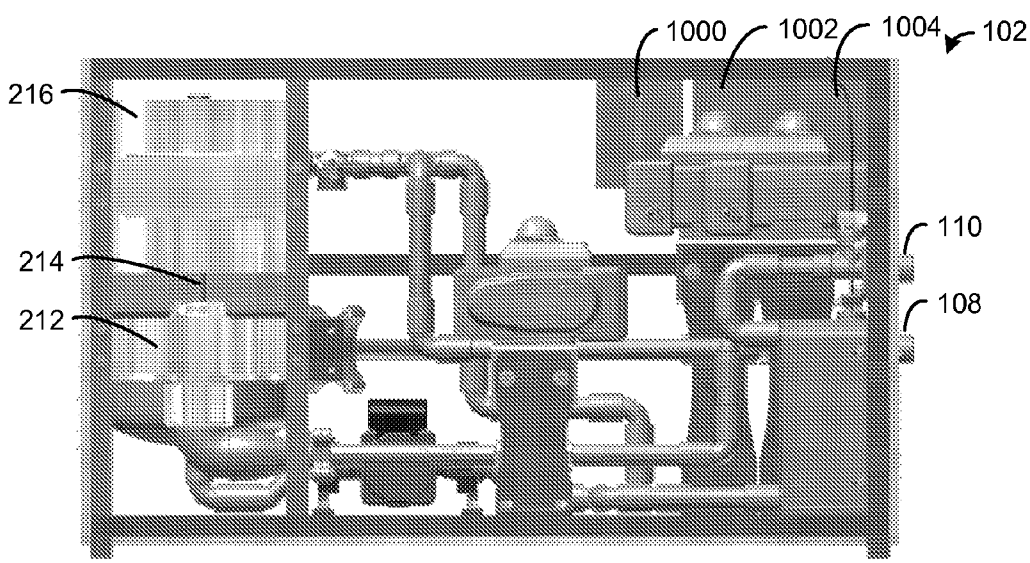


FIG. 10C

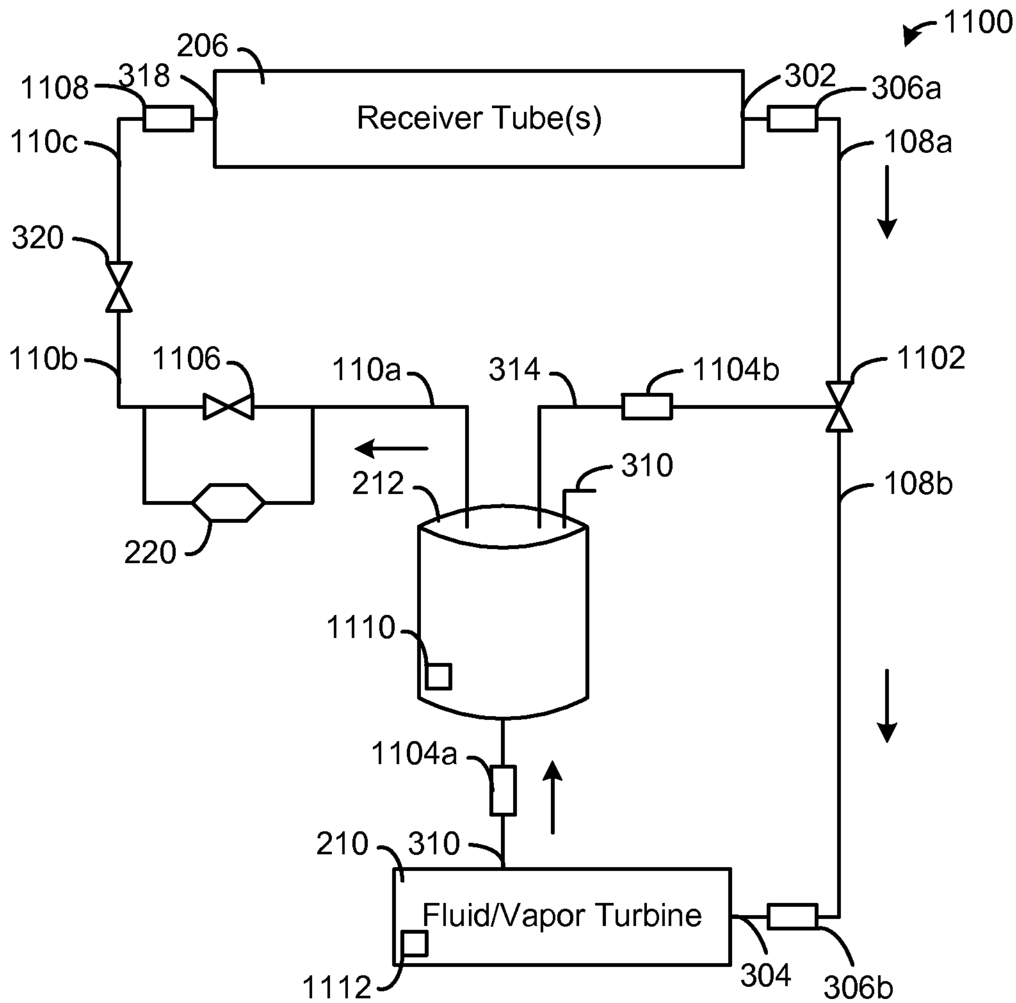

1100
206
318
1108
302
306a
Receiver Tube(s)
110c
108a
320
110b
1106
110a
314
1104b
1102
310
212
108b
220
1110
1104a
210
310
Fluid/Vapor Turbine
1112
304
306b

FIG. 11

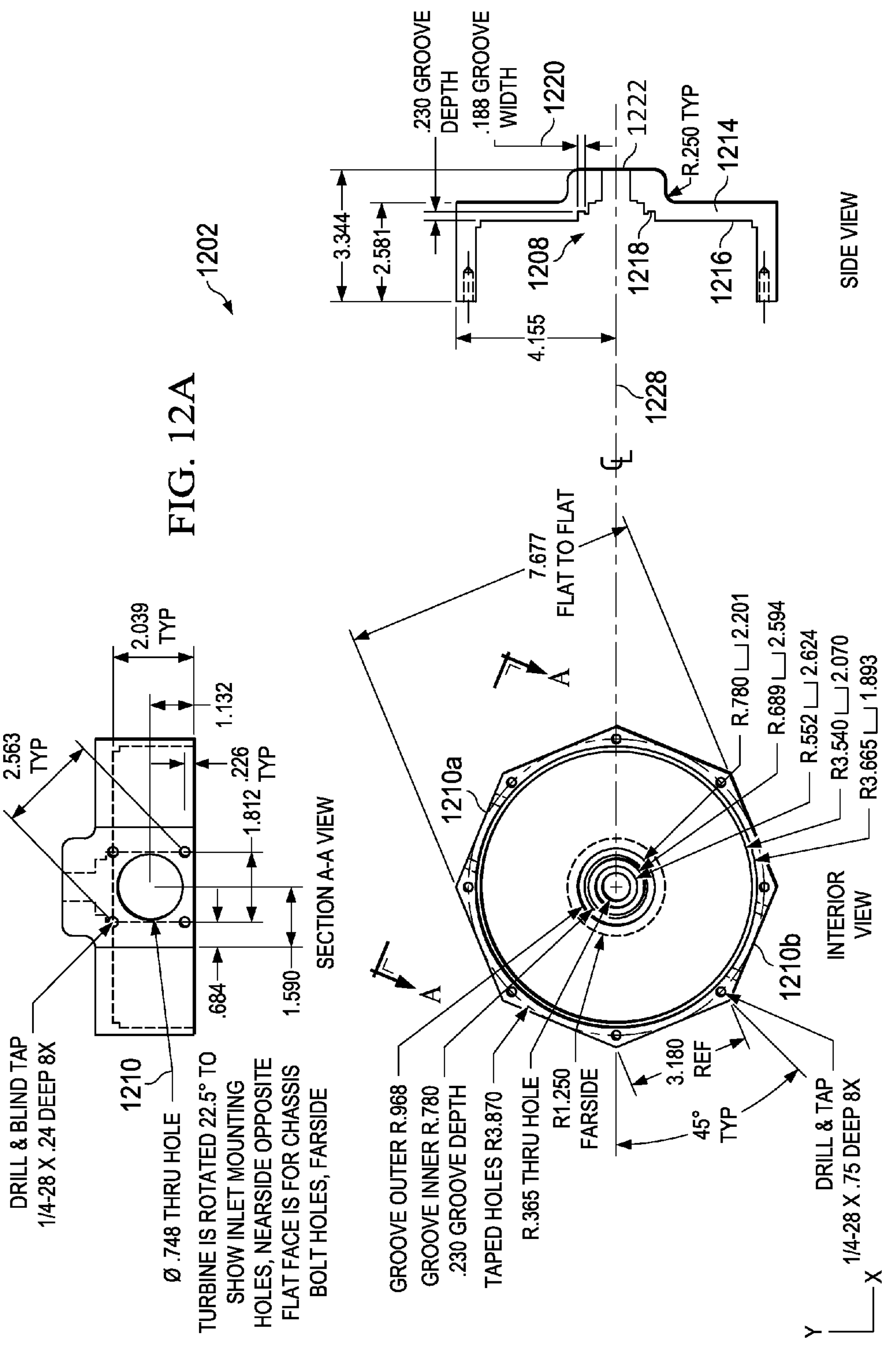

1202
.230 GROOVE DEPTH
.188 GROOVE WIDTH
1220
1222
R.250 TYP
1214
3.344
2.581
1208
1218
1216
4.155
1228
SIDE VIEW
2.563 TYP
2.039 TYP
1.132
.226 TYP
1.812
.684
1.590
SECTION A-A VIEW
DRILL & BLIND TAP 1/4-28 X .24 DEEP 8X
1210
Ø .748 THRU HOLE
TURBINE IS ROTATED 22.5° TO SHOW INLET MOUNTING HOLES, NEARSIDE OPPOSITE FLAT FACE IS FOR CHASSIS BOLT HOLES, FARSIDE
7.677 FLAT TO FLAT
A
A
1210a
1210b
R.780 2.201
R.689 2.594
R.552 2.624
R3.540 2.070
R3.665 1.893
INTERIOR VIEW
GROOVE OUTER R.968
GROOVE INNER R.780
.230 GROOVE DEPTH
TAPED HOLES R3.870
R.365 THRU HOLE
R1.250 FARSIDE
3.180 REF
45° TYP
DRILL & TAP 1/4-28 X .75 DEEP 8X
Y
X

FIG. 12A

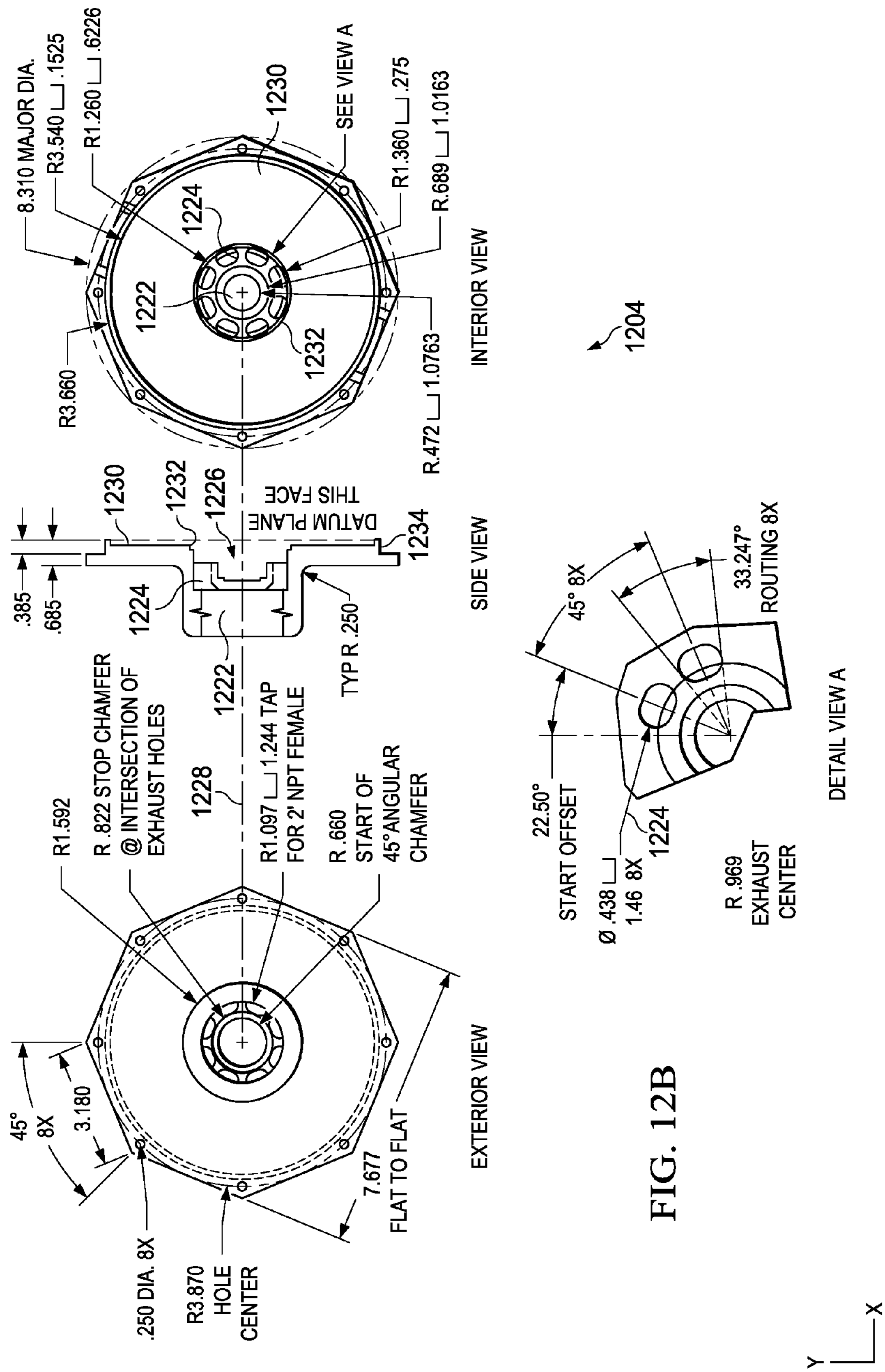

8.310 MAJOR DIA.
R3.540 ⌴ .1525
R1.260 ⌴ .6226
1230
SEE VIEW A
1224
R1.360 ⌴ .275
R.689 ⌴ 1.0163
1222
1232
R3.660
R.472 ⌴ 1.0763
INTERIOR VIEW
1204
.385
.685
1230
1232
1226
DATUM PLANE
THIS FACE
1234
1224
1222
TYP R .250
SIDE VIEW
45° 8X
33.247°
ROUTING 8X
22.50°
START OFFSET
Ø .438 ⌴
1.46 8X
1224
R .969
EXHAUST
CENTER
DETAIL VIEW A
R1.592
R .822 STOP CHAMFER
@ INTERSECTION OF
EXHAUST HOLES
1228
R1.097 ⌴ 1.244 TAP
FOR 2' NPT FEMALE
R .660
START OF
45°ANGULAR
CHAMFER
45°
8X
3.180
7.677
FLAT TO FLAT
EXTERIOR VIEW
.250 DIA. 8X
R3.870
HOLE
CENTER
Y
X

FIG. 12B

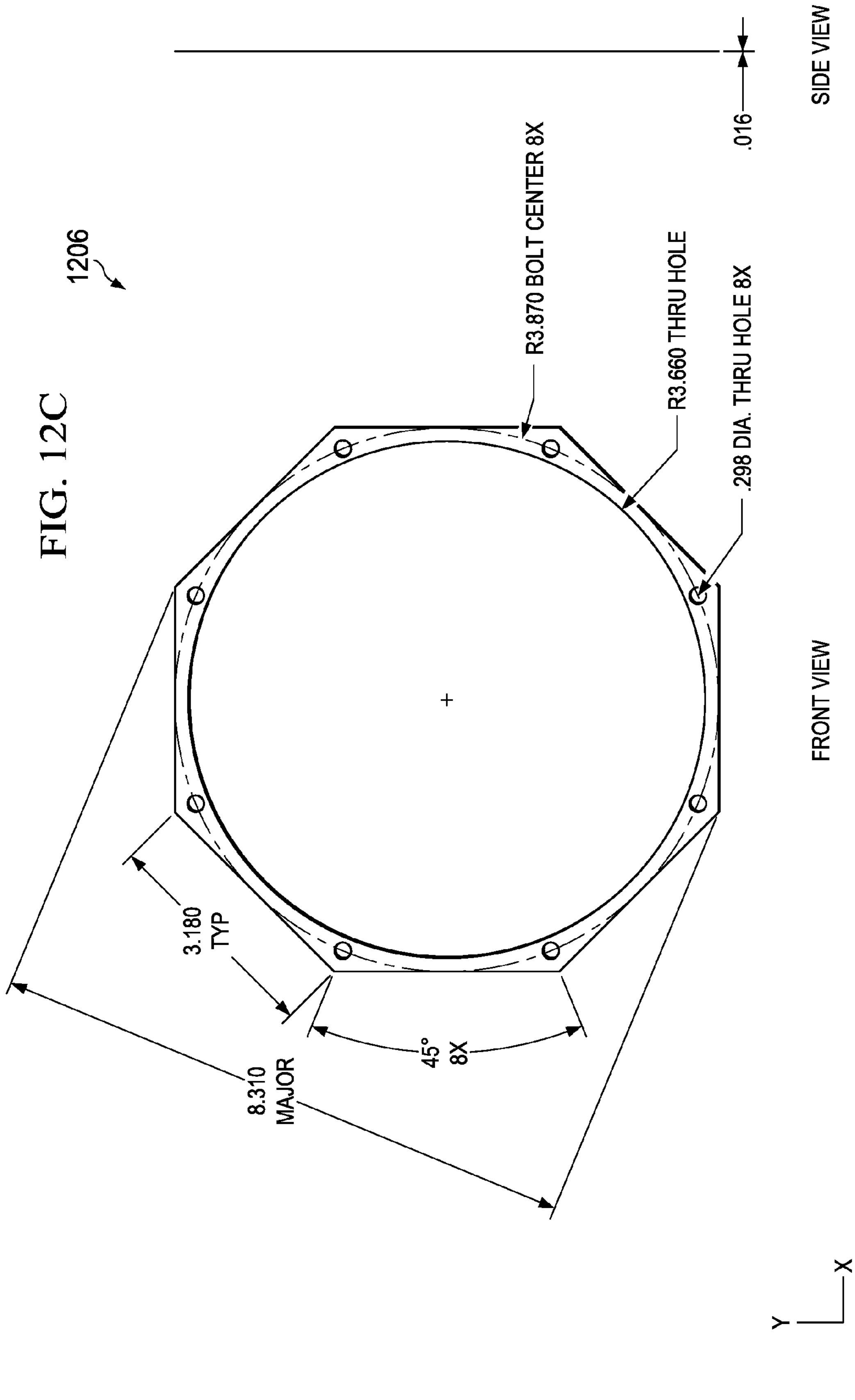

1206
R3.870 BOLT CENTER 8X
R3.660 THRU HOLE
.298 DIA. THRU HOLE 8X
.016
SIDE VIEW
FRONT VIEW
3.180
TYP
45°
8X
8.310
MAJOR
X
Y

FIG. 12C

FIG. 13A

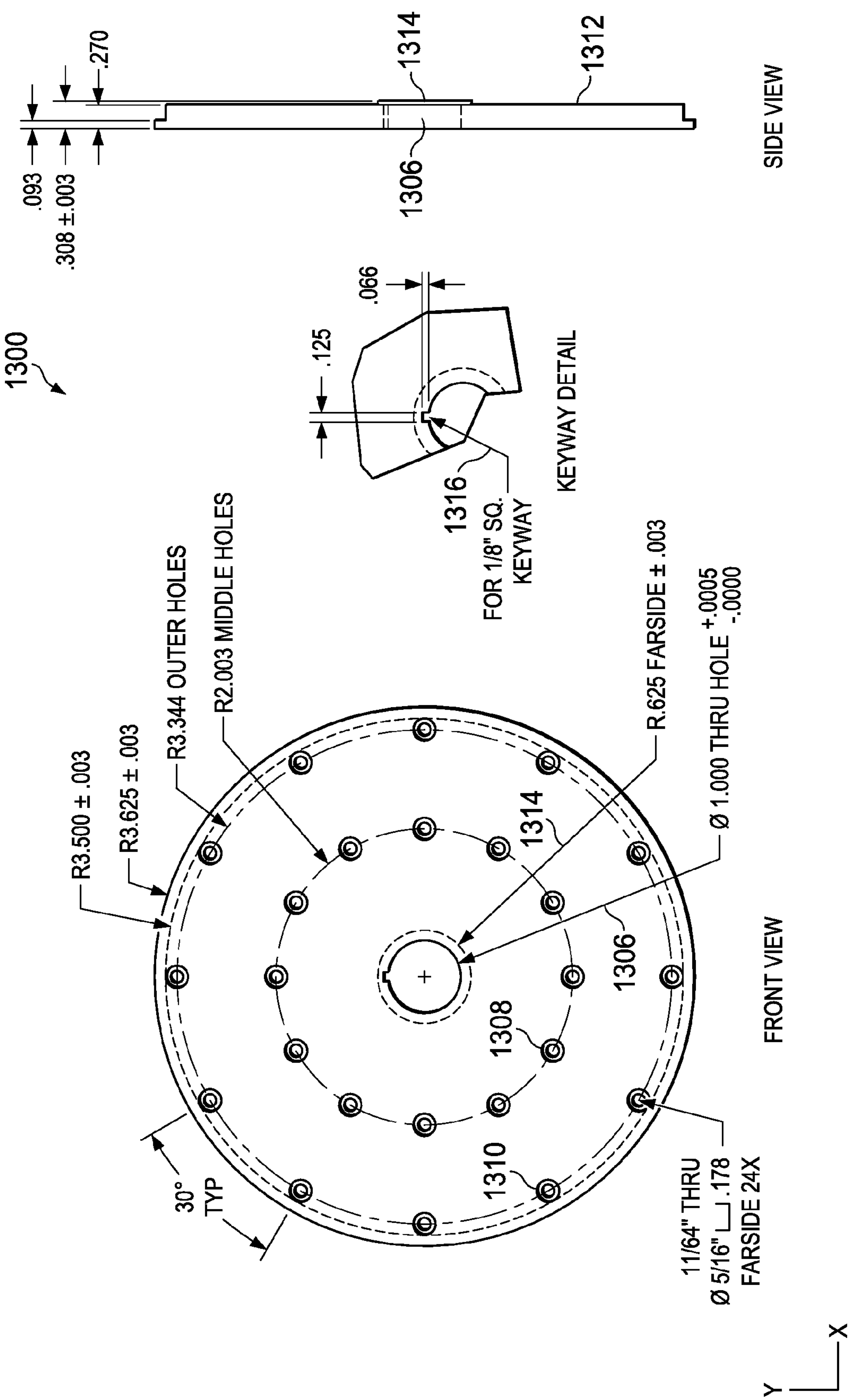
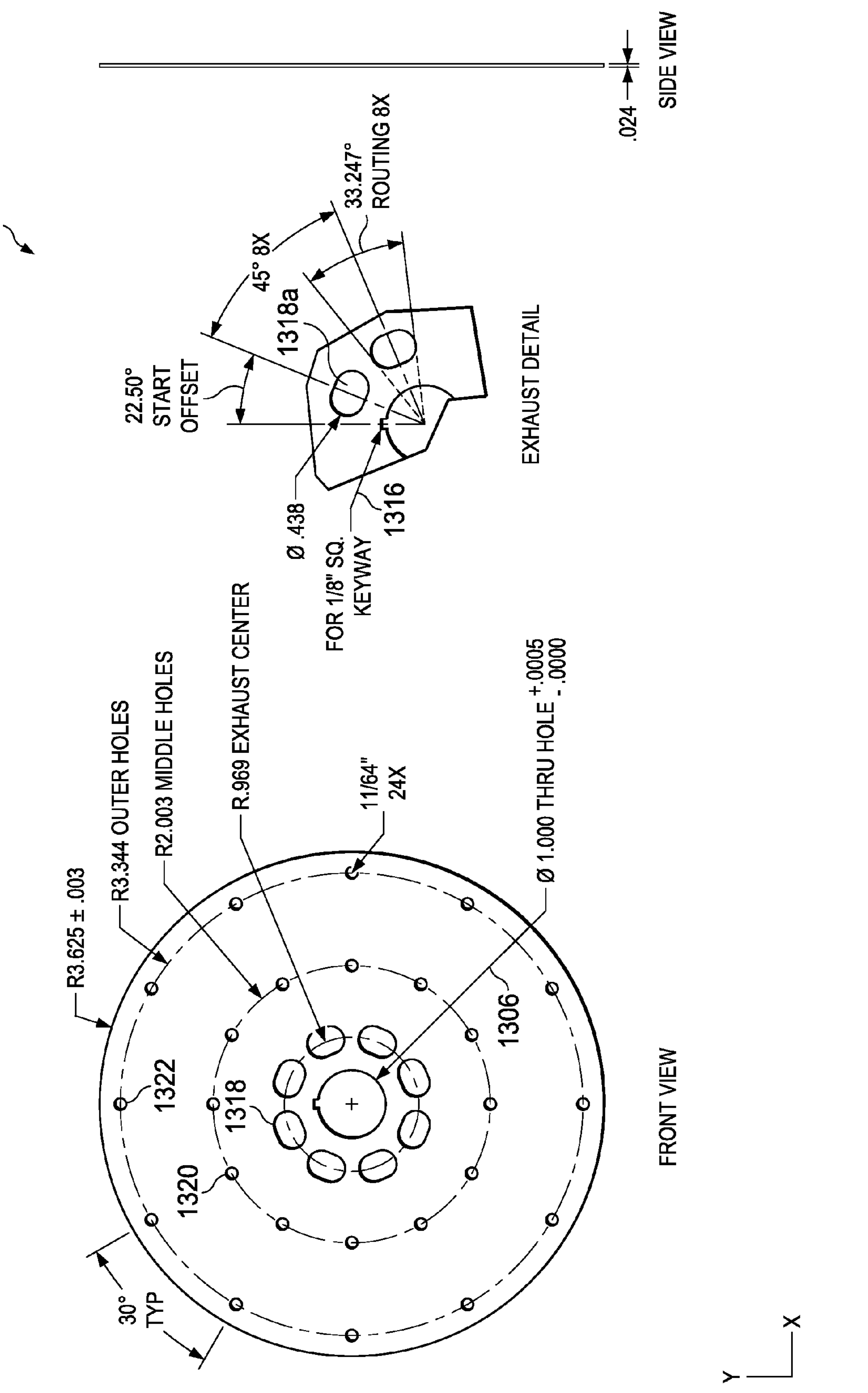
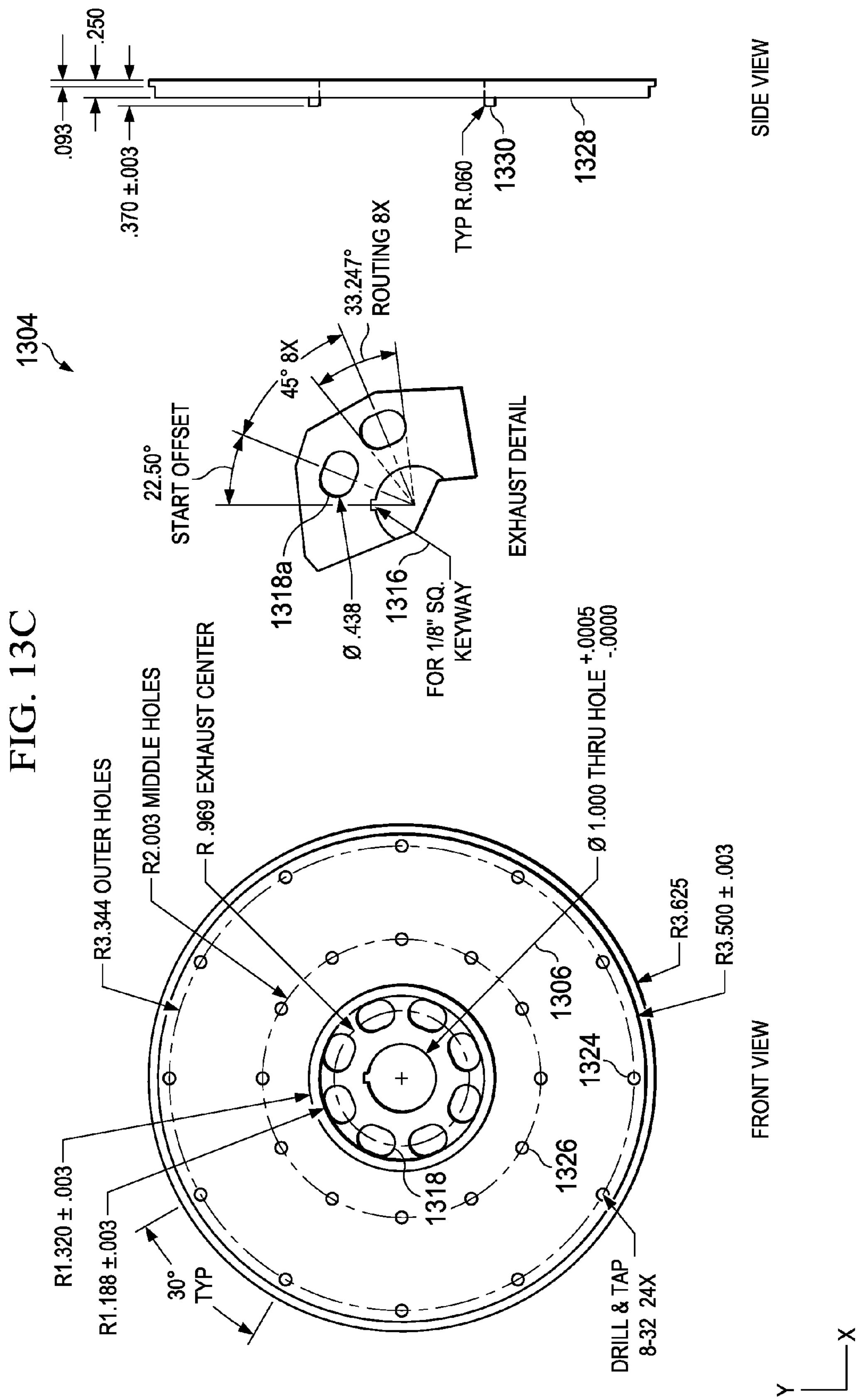

1300
.093
.308 ±.003
.270
1314
1312
1306
SIDE VIEW
.066
.125
1316
FOR 1/8" SQ.
KEYWAY
KEYWAY DETAIL
R3.500 ± .003
R3.625 ± .003
R3.344 OUTER HOLES
R2.003 MIDDLE HOLES
R.625 FARSIDE ± .003
Ø 1.000 THRU HOLE +.0005 -.0000
1314
1306
1308
1310
30° TYP
11/64" THRU
Ø 5/16" ⌴ .178
FARSIDE 24X
FRONT VIEW
Y
X

FIG. 13B



1302
SIDE VIEW
.024
33.247° ROUTING 8X
45° 8X
1318a
22.50° START OFFSET
EXHAUST DETAIL
Ø .438
FOR 1/8" SQ. KEYWAY
1316
R3.625 ± .003
R3.344 OUTER HOLES
R2.003 MIDDLE HOLES
R.969 EXHAUST CENTER
11/64" 24X
Ø 1.000 THRU HOLE +.0005 -.0000
1306
1322
1318
1320
30° TYP
FRONT VIEW
X
Y



1304
.250
.093
.370 ±.003
TYP R.060
1330
1328
SIDE VIEW
22.50°
START OFFSET
45° 8X
33.247°
ROUTING 8X
1318a
Ø .438
1316
FOR 1/8" SQ.
KEYWAY
EXHAUST DETAIL
R3.344 OUTER HOLES
R2.003 MIDDLE HOLES
R .969 EXHAUST CENTER
Ø 1.000 THRU HOLE +.0005 -.0000
1306
R3.625
R3.500 ± .003
1324
1326
1318
R1.320 ± .003
R1.188 ±.003
30°
TYP
DRILL & TAP
8-32 24X
FRONT VIEW
Y
X

FIG. 13C

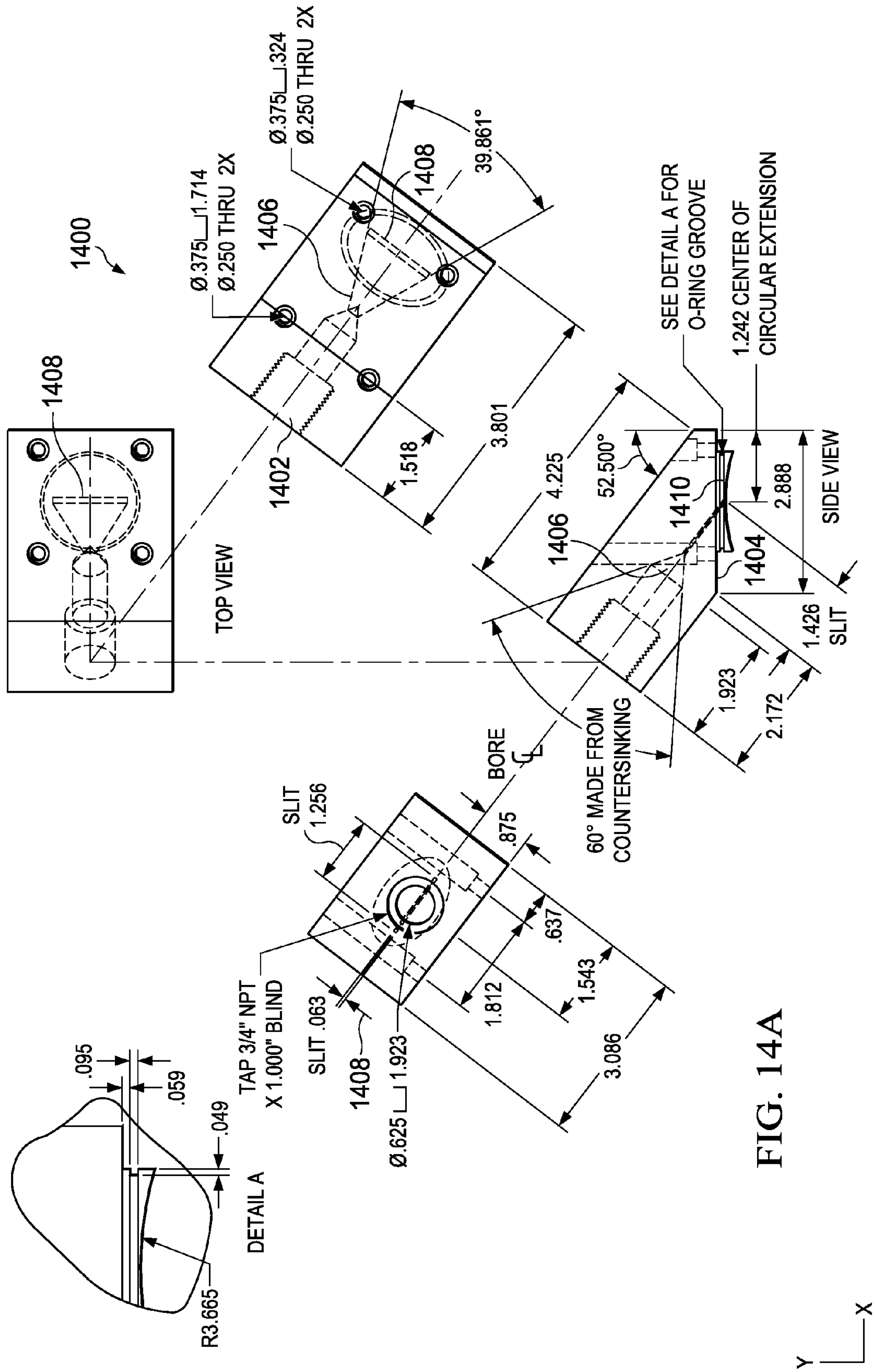

1400
1402
1404
1406
1408
1410
TOP VIEW
SIDE VIEW
DETAIL A
Ø.375⌴1.714
Ø.250 THRU 2X
Ø.375⌴.324
Ø.250 THRU 2X
39.861°
3.801
1.518
SEE DETAIL A FOR
O-RING GROOVE
1.242 CENTER OF
CIRCULAR EXTENSION
4.225
52.500°
2.888
1.426
SLIT
1.923
2.172
60° MADE FROM
COUNTERSINKING
BORE
℄
SLIT
1.256
.875
.637
1.812
1.543
3.086
TAP 3/4" NPT
X 1.000" BLIND
SLIT .063
Ø.625⌴1.923
.095
.059
.049
R3.665
Y
X

FIG. 14A

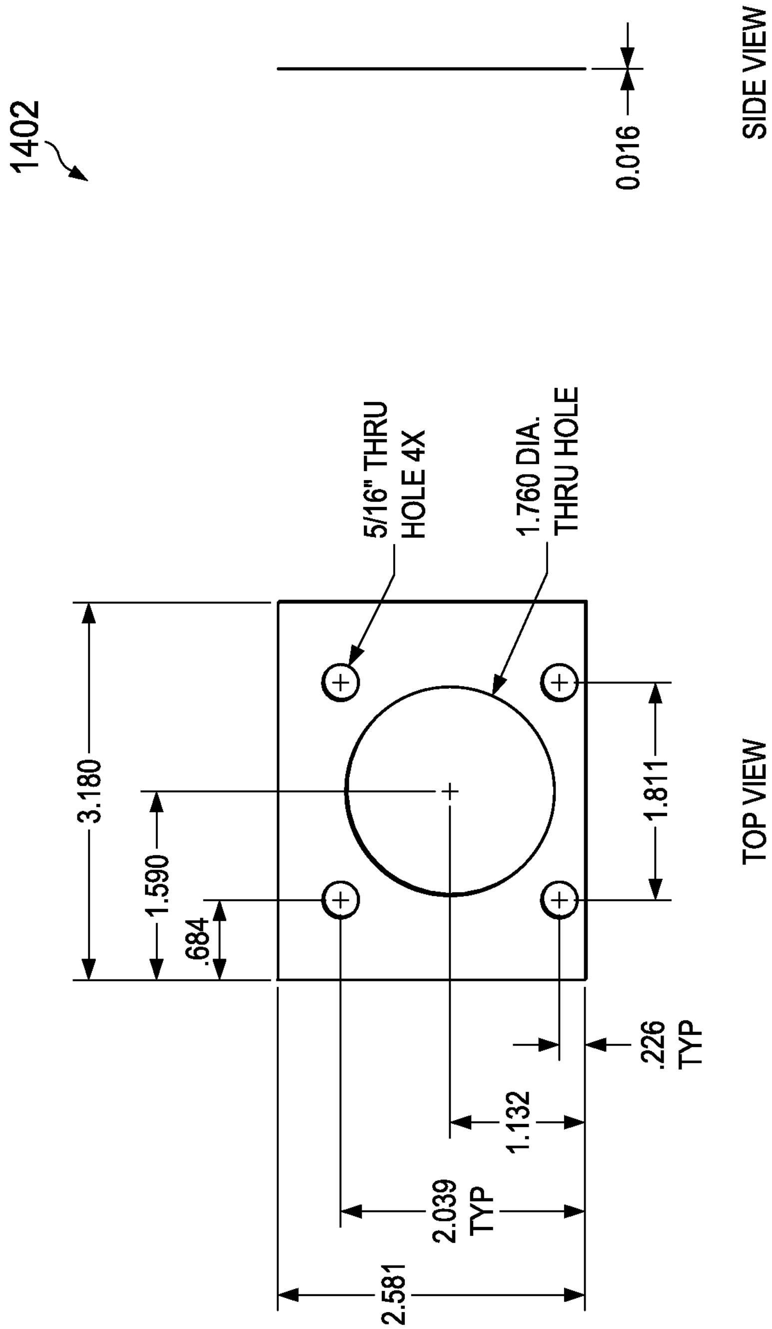
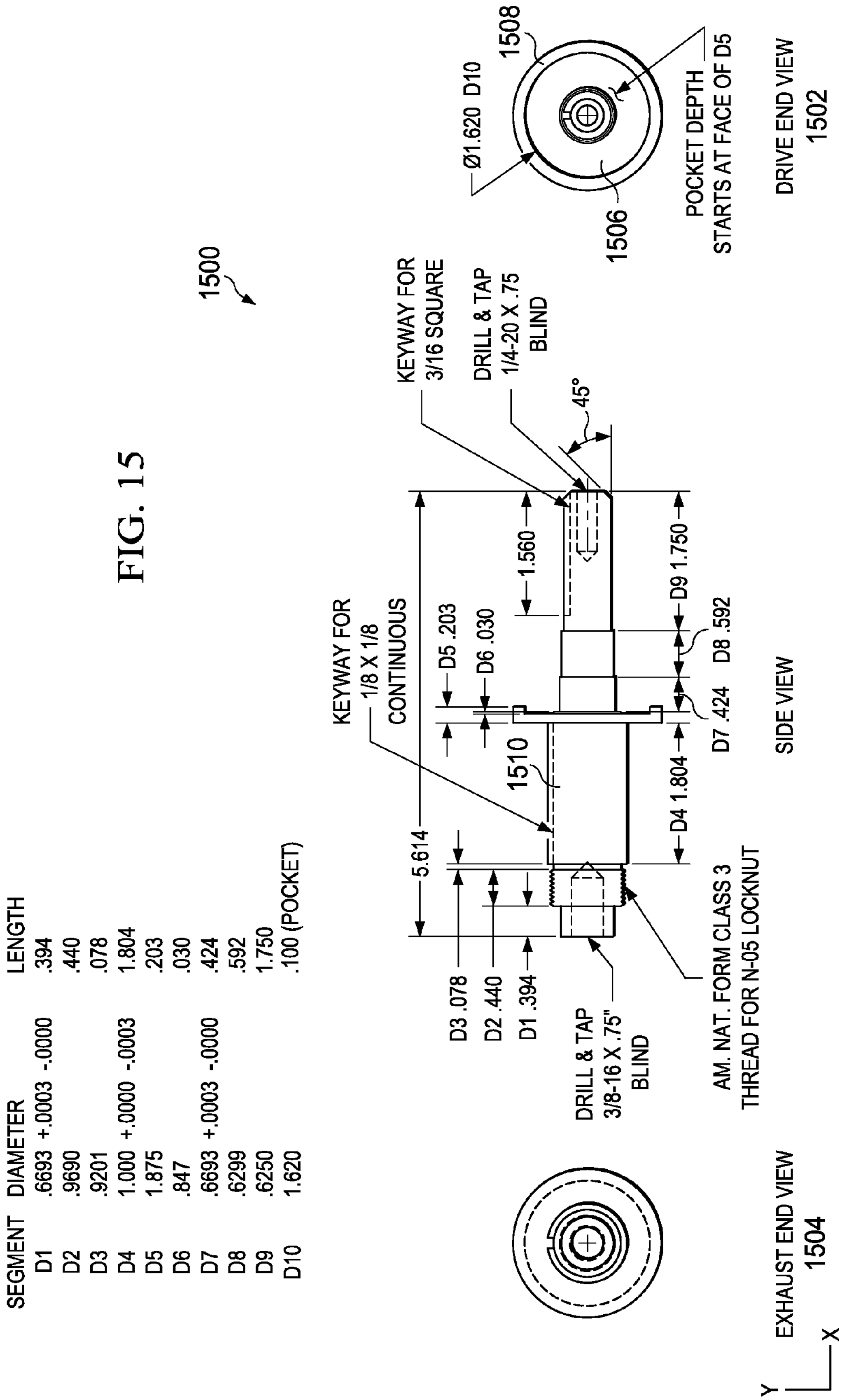

1402
0.016
SIDE VIEW
5/16" THRU HOLE 4X
1.760 DIA. THRU HOLE
3.180
1.590
.684
1.811
TOP VIEW
.226 TYP
1.132
2.039 TYP
2.581

FIG. 14B

FIG. 15


1500
SEGMENT DIAMETER LENGTH
D1 .6693 +.0003 -.0000 .394
D2 .9690 .440
D3 .9201 .078
D4 1.000 +.0000 -.0003 1.804
D5 1.875 .203
D6 .847 .030
D7 .6693 +.0003 -.0000 .424
D8 .6299 .592
D9 .6250 1.750
D10 1.620 .100 (POCKET)
KEYWAY FOR 1/8 X 1/8 CONTINUOUS
KEYWAY FOR 3/16 SQUARE
DRILL & TAP 1/4-20 X .75 BLIND
45°
5.614
1.560
D5 .203
D6 .030
1510
D3 .078
D2 .440
D1 .394
D4 1.804
D7 .424
D8 .592
D9 1.750
DRILL & TAP 3/8-16 X .75" BLIND
AM. NAT. FORM CLASS 3 THREAD FOR N-05 LOCKNUT
SIDE VIEW
Ø1.620 D10
1508
1506
POCKET DEPTH STARTS AT FACE OF D5
DRIVE END VIEW
1502
EXHAUST END VIEW
1504
Y
X

BLADELESS TURBINE

FIELD OF INVENTION

The present invention relates generally to the field of power generation and, more particularly, to a bladeless turbine.

BACKGROUND ART

The high cost, diminishing supply and environmental impact of fossil fuels continues to promote interest in solar energy, biomass combustion, geothermal heat, industrial waste heat recovery and other alternative clean energy sources. For example, solar energy has been used to heat water for use in homes and businesses for many years. Likewise, direct conversion of solar energy to electricity has been used for many years for satellites and spacecraft. But, these existing solar energy systems typically have low thermal efficiencies, require large installation areas and/or require expensive components. As a result, systems to efficiently and cost effectively convert solar energy to electricity are not available to the general public.

Accordingly, there is a need for a more efficient and economical turbine for use in solar energy, biomass combustion, geothermal heat and industrial waste heat recovery systems.

SUMMARY OF THE INVENTION

The present invention provides a bladeless turbine for driving mechanical loads and generating AC electrical power in solar energy, biomass combustion, geothermal heat and industrial waste heat recovery systems.

More specifically, the present invention provides a bladeless fluid/vapor turbine having a drive shaft, one or more fluid/vapor inlets and a fluid/vapor outlet. The bladeless fluid/vapor turbine includes: (a) a case comprising a main housing, a cover and a centerline, (b) three or more turbine discs disposed within the case, wherein each turbine disc has a center opening, and two or more of the turbine discs have a set of exhaust ports positioned annularly around the center opening, (c) the drive shaft passes through the center openings of the three or more turbine discs and is attached to the three or more turbine discs, wherein the drive shaft is positioned within the case along the centerline, free to rotate within the case, and extends through the main housing for connection to a generator, (d) the one or more fluid/vapor inlets are attached to the main housing such that a fluid/vapor is directed at a specified angle onto the three or more turbine discs, (e) the fluid/vapor outlet is disposed in the cover and aligned with the centerline, (f) a set of exhaust holes proximate to and connected to the fluid/vapor outlet that are positioned annularly around the drive shaft, and (g) wherein the fluid/vapor causes the turbine discs to rotate, passes through the set of exhaust ports and the set of exhaust holes, and exits through the fluid/vapor outlet.

In addition, the present invention provides a solar power system that includes one or more solar collectors, a solar tracking device, a bladeless fluid/vapor turbine, a generator and a controller. Each solar collector includes (a) one or more support structures for securely mounting the solar collector to a surface, (b) a reflective parabolic trough for concentrating solar energy along a focal axis and attached to the support structure(s) to allow rotation of the reflective parabolic trough around a longitudinal axis, (c) one or more receiver tubes attached to the reflective parabolic trough along the focal axis, and (d) a motor operably connected to the reflective parabolic trough to rotate the reflective parabolic trough around the

longitudinal axis. Each receiver tube includes (i) a metal tube having an inlet, an outlet and a solar absorption coating, and (ii) a transparent tube having a first seal and a second seal to vacuum or hermetically seal the metal tube between approximately the inlet and the outlet within the transparent tube. The solar tracking device has one or more sensors to control the motor to align each solar collector to maximize the solar energy collected by the one or more receiver tubes. The bladeless fluid/vapor turbine has a drive shaft, one or more fluid/vapor inlets connected to the outlet of the receiver tube(s) and a fluid/vapor outlet connected to the inlet of the receiver tube(s). The bladeless fluid/vapor turbine includes: (a) a case comprising a main housing, a cover and a centerline, (b) three or more turbine discs disposed within the case, wherein each turbine disc has a center opening, and two or more of the turbine discs have a set of exhaust ports positioned annularly around the center opening, (c) the drive shaft passes through the center openings of the three or more turbine discs and is attached to the three or more turbine discs, wherein the drive shaft is positioned within the case along the centerline, free to rotate within the case, and extends through the main housing for connection to a generator, (d) the one or more fluid/vapor inlets are attached to the main housing such that a fluid/vapor is directed at a specified angle onto the three or more turbine discs, (e) the fluid/vapor outlet is disposed in the cover and aligned with the centerline, (f) a set of exhaust holes proximate to and connected to the fluid/vapor outlet that are positioned annularly around the drive shaft, and (g) wherein the fluid/vapor causes the turbine discs to rotate, passes through the set of exhaust ports and the set of exhaust holes, and exits through the fluid/vapor outlet. The generator is connected to the drive shaft of the fluid/vapor turbine and having one or more electrical output terminals. The controller is connected to the motor, the solar tracking device, the fluid/vapor turbine and the generator to monitor and control the system.

In addition, the present invention provides a solar power system that includes one or more solar collectors, a solar tracking device, a fluid/vapor turbine, a generator and a controller. Each solar collector includes (a) one or more support structures for securely mounting the solar collector to a surface, (b) a reflective parabolic trough for concentrating solar energy along a focal axis and attached to the support structure(s) to allow rotation of the reflective parabolic trough around a longitudinal axis, (c) one or more receiver tubes attached to the reflective parabolic trough along the focal axis, and (d) a motor operably connected to the reflective parabolic trough to rotate the reflective parabolic trough around the longitudinal axis. Each receiver tube includes (i) a metal tube having an inlet, an outlet and a solar absorption coating, and (ii) a transparent tube having a first seal and a second seal to vacuum or hermetically seal the metal tube between approximately the inlet and the outlet within the transparent tube. The solar tracking device has one or more sensors to control the motor to align each solar collector to maximize the solar energy collected by the one or more receiver tubes, wherein the sensors comprise three or more photosensitive diodes disposed on the reflective parabolic trough such that when the reflective parabolic through is properly aligned: at least a first of the photosensitive diodes is positioned within a center of a shadow cast by the receiver tube(s), a least a second of the photosensitive diodes is positioned within and near a first edge of the shadow cast by the receiver tube(s), and a least a third of the photosensitive diodes is positioned within and near a second edge of the shadow cast by the receiver tube(s). The fluid/vapor turbine has a drive shaft, a fluid/vapor inlet and a fluid/vapor outlet. The bladeless fluid/vapor turbine includes: (a) a case comprising a main housing, a cover and a centerline, (b) three or more turbine discs disposed within the case, wherein each turbine disc has a center opening, and two or more of the turbine discs have a set of exhaust ports positioned annularly around the center opening, (c) the drive shaft passes through the center openings of the three or more turbine discs and is attached to the three or more turbine discs, wherein the drive shaft is positioned within the case along the centerline, free to rotate within the case, and extends through the main housing for connection to a generator, (d) the one or more fluid/vapor inlets are attached to the main housing such that a fluid/vapor is directed at a specified angle onto the three or more turbine discs, (e) the fluid/vapor outlet is disposed in the cover and aligned with the centerline, (f) a set of exhaust holes proximate to and connected to the fluid/vapor outlet that are positioned annularly around the drive shaft, and (g) wherein the fluid/vapor causes the turbine discs to rotate, passes through the set of exhaust ports and the set of exhaust holes, and exits through the fluid/vapor outlet. The generator is connected to the drive shaft of the fluid/vapor turbine and having one or more electrical output terminals. A first operating pressure modulation valve and a temperature/pressure sensor are connected between the outlet of the receiver tube(s) and the fluid/vapor inlet of the fluid/vapor turbine. A back flow prevention valve is connected to the fluid/vapor outlet of the fluid/vapor turbine. A pressure vessel is connected to the back flow prevention valve. A secondary line connects the pressure vessel to a hose or pipe between the outlet of the receiver tube(s) and the first operating pressure modulation valve. A third operating pressure modulation valve is disposed in the secondary line. A primer/boost pump is connected to the pressure vessel. A second operating pressure modulation valve is connected between the primer/boost pump and the inlet of the receiver tube(s). A controller is connected to the motor, the solar tracking device, the fluid/vapor turbine and the generator to monitor and control the system.

The present invention is described in detail below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Further benefits and advantages of the present invention will become more apparent from the following description of various embodiments that are given by way of example with reference to the accompanying drawings:

FIG. **1** is a high level block diagram of a solar energy power generation system in accordance with one embodiment of the present invention;

FIG. **2** is a block diagram of a turbine and generator assembly connected to solar collector (trough) in accordance with one embodiment of the present invention;

FIG. **3** is a block diagram showing the valve and piping layout for a solar energy power generation system in accordance with one embodiment of the present invention;

FIG. **4** is a diagram of a reflective parabolic trough in accordance with one embodiment of the present invention;

FIGS. **5**A and **5**B are diagrams of a solar tracking device mounted on a reflective parabolic trough in accordance with one embodiment of the present invention;

FIG. **6** is a diagram of some structural details of a reflective parabolic trough in accordance with one embodiment of the present invention;

FIG. **7** is a diagram of a motor assembly for rotating a reflective parabolic trough in accordance with one embodiment of the present invention;

FIGS. **8**A and **8**B are diagrams of a receiver tube in accordance with one embodiment of the present invention;

FIG. **9** is a diagram of a support structure in accordance with one embodiment of the present invention;

FIGS. **10**A-**10**C are various diagrams of a housing for some of the components in accordance with one embodiment of the present invention;

FIG. **11** is a block diagram showing the valve and piping layout for a solar energy power generation system in accordance with another embodiment of the present invention;

FIGS. **12**A, **12**B and **12**C are diagrams of a turbine case and gasket in accordance with one embodiment of the present invention;

FIGS. **13**A, **13**B and **13**C are diagrams of the rear, intermediate and front discs, respectively, for the fluid/vapor turbine in accordance with one embodiment of the present invention;

FIGS. **14**A and **14**B are diagrams of an inlet nozzle and gasket for the fluid/vapor turbine in accordance with one embodiment of the present invention; and

FIG. **15** is a diagram of a shaft for the fluid/vapor turbine in accordance with one embodiment of the present invention.

DESCRIPTION OF THE INVENTION

While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides many applicable inventive concepts that can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention and do not delimit the scope of the invention.

To facilitate the understanding of this invention, a number of terms are defined below. Terms defined herein have meanings as commonly understood by a person of ordinary skill in the areas relevant to the present invention. Terms such as “a”, “an” and “the” are not intended to refer to only a singular entity, but include the general class of which a specific example may be used for illustration. The terminology herein is used to describe specific embodiments of the invention, but their usage does not delimit the invention, except as outlined in the claims.

The present invention provides a bladeless turbine for driving mechanical loads and generating AC electrical power in solar energy, biomass combustion, geothermal heat and industrial waste heat recovery systems. FIGS. **1**-**11** depict an example of how the bladeless turbine in accordance with the present invention can be used in a solar energy power generation system. FIGS. **12**-**15** provide details of the bladeless turbine in accordance with the present invention that can be used in many types of systems, such as solar energy, biomass combustion, geothermal heat, industrial waste heat recovery, and other “green” or semi-“green” systems. As will be appreciated by those skilled in the art, the bladeless turbine in accordance with the present invention is not limited to those systems specifically mentioned or described herein.

Now referring to FIG. **1**, a high level block diagram of a solar energy power generation system **100** in accordance with one embodiment of the present invention is shown. The solar energy power generation system **100** provides an encapsulated solution in which all components and fluids are fully contained within a single compact unit. The major subsystems of the solar energy power generation system **100** are a turbine and generator assembly **102** and a solar collector array **104** that can have one or more solar collectors (troughs) **106**. In one example, the turbine and generator assembly **102** weighs approximately 150 lbs and is approximately 4 ft×2 ft×2 ft, and the solar collector (trough) **106** weighs approximately 105 lbs and is approximately 4 ft×12 ft. The turbine and generator assembly **102** are connected to the one or more solar collectors (troughs) **106** with input **108** and output **110** hoses or pipes. A low power cable **112** (e.g., 5V) runs from the turbine and generator assembly **102** to the one or more solar collectors (troughs) **106**). Power generated by the turbine and generator assembly **102** is provided to the home, building, business, electrical load or utility circuit via a power connection **114**. Note that various meters, relays, breakers, reverse power flow sensors and other monitoring/protection devices may be installed between the generator and the home, building, business, electrical load or utility circuit. The turbine and generator assembly **102** and the solar collector (troughs) **106** will be described in more detail below. Note that the number of solar collectors (troughs) **106** shown in FIG. **1** is merely for illustration purposes and present invention is not limited to the number of solar collector shown.

Referring now to FIG. **2**, a block diagram of a turbine and generator assembly **102** connected to solar collector (trough) **106** in accordance with one embodiment of the present invention is shown. The turbine and generator assembly **102** is contained within a weather resistant cabinet **200** suitable for ground or attic installations. The solar energy power generation system **100** can be controlled and monitored by user interface **202** (software) that allows remote control and monitoring of the system. The user interface **202** is not the code running on the controller **204** (e.g., Programmable Logic Controller). Instead, user interface **202** provides allows a user to track power consumption, power production, system diagnostics and other control/monitoring functions. The user interface **202** can be installed on any user device communicably coupled to the controller. For example, the user device may include a computer, a laptop, a PDA, a phone, a mobile communications device or other electronic device. The user device having user interface **202** can be communicably coupled to the controller **204** via a direct connection, a network connection, a USB connection, a wireless network, a wide area network or a combination thereof.

The solar collector **106** includes one or more support structures for securely mounting the solar collector **106** to a surface (not shown), a reflective parabolic trough for concentrating solar energy along a focal axis, one or more receiver tubes **206** attached to the reflective parabolic trough along the focal axis, a motor **208** operably connected to the reflective parabolic trough to rotate the reflective parabolic trough around the longitudinal axis, and a solar tracking device or circuit **210**. A typical installation will have six solar collectors **106**, although the exact number of solar collectors **106** will be determined by various design specifications, such as energy requirements, geographic location, physical constraints and other factors.

The weather resistant cabinet **200** provides protection and concealment of a fluid/vapor turbine **212** having a drive shaft **214**, a generator **216** connected to the drive shaft **214** of the fluid/vapor turbine **212**, a controller **204**, a pressure vessel **218** and a primer/boost pump **220**. The generator **216** and the fluid/vapor turbine **212** can be directly coupled or coupled through a transmission or gear assembly. Note that the fluid/vapor turbine **212** can be a Tesla engine, Sterling engine or an organic Rankine cycle steam turbine. The organic Rankine cycle steam turbine has numerous advantages including, but not limited to, its bladeless design that can extract energy from very high temperatures (fully vaporized fluids) to very low temperatures (fully saturated fluids) without damage. The fluid/vapor turbine **212**, pressure vessel **218** and primer/boost pump **220** are connected together and to the receiver tube(s) **206** with input **108** and output **110** hoses or pipes. A low power cable **112** (e.g., 5V) runs from the cabinet **200** to each solar collector **106** (typically in a daisy chain). Power generated by the generator **216** is provided to the home, building, business, electrical load or utility circuit via a power connection **114** (e.g., 480VAC (three phase), 240VAC (single phase), etc. Note that various meters, relays, breakers, reverse power flow sensors and other monitoring/protection devices may be installed between the generator and the home, building, business, electrical load or utility circuit. The controller **204** is connected to the motor **208**, the solar tracking device **210**, the fluid/vapor turbine **212** and the generator **216** to monitor and control the system. The controller **204** can be a PLC, PCB, computer or SCADA system.

In other words, the present invention provides a solar power system **100** that includes one or more solar collectors **106**, a solar tracking device **210**, a fluid/vapor turbine **212**, a generator **216** and a controller **204**. Each solar collector **106** includes (a) one or more support structures **404** for securely mounting the solar collector **106** to a surface, (b) a reflective parabolic trough **400** for concentrating solar energy along a focal axis and attached to the support structure(s) **404** to allow rotation of the reflective parabolic trough **400** around a longitudinal axis, (c) one or more receiver tubes **206** attached to the reflective parabolic trough **400** along the focal axis, and (d) a motor **208** operably connected to the reflective parabolic trough **400** to rotate the reflective parabolic trough **400** around the longitudinal axis. Each receiver tube **206** includes (i) a metal tube **804** having an inlet **318**, an outlet **302** and a solar absorption coating, and (ii) a transparent tube **802** having a first seal and a second seal to vacuum or hermetically seal the metal tube **804** between approximately the inlet **318** and the outlet **302** within the transparent tube **802**. The solar tracking device **210** has one or more sensors **500** to control the motor **208** to align each solar collector **106** to maximize the solar energy collected by the one or more receiver tubes **206**. The fluid/vapor turbine **212** has a drive shaft **214**, a fluid/vapor inlet **304** connected to the outlet **203** of the receiver tube(s) **206** and a fluid/vapor outlet **310** connected to the inlet of the receiver tube(s) **318**. The generator **216** is connected to the drive shaft **214** of the fluid/vapor turbine **212** and has one or more electrical output terminals **114**. The controller **204** is connected to the motor **208**, the solar tracking device **210**, the fluid/vapor turbine **212** and the generator **216** to monitor and control the system **100**. The controller **204** can also position each solar collector **106** to minimize damage in potentially damaging weather via on-site sensors or remote input from the National Weather Service or other alert system. For example, the controller **204** can utilize a storm mode and sleep cycles to position each collector **106** to minimize abrasions, damage and moisture collection during non-productive periods.

In one embodiment, six to eight solar collectors will be required for 10 kW output based on 4.45 square meters of surface per collector. For example, the specifications for a system in accordance with one embodiment of the present invention are:

Turbine/Generator

Output	10 kW
Input Pressure	140 PISG
Exhaust Pressure	10 PSIG (Max)
Inlet Temperature	361° F.
Outlet Temperature	240° F.
Steam Usage	2700 LB/HR
Inlet Pipe (OD)	One inch

Conversion Rates
1 BTU=1.06 kJ
1 Ib=0.4536 kg
Solar Collector Calculations

Energy from Sun (clear summer day)	1,000 W/m^2
Parabolic Trough	4 ft × 12 ft = 4.46 m^2
Collector Efficiency	0.68
Power from Collector	1000 × 4.46 × 0.68 = 3.033 kW per trough
Six Troughs =	18.197 kW of energy available from the Sun

Steam Characteristics
Total heat of steam at 240° F.=1160 BTU/lb
Total heat of steam at 361° F.=1194 BTU/lb
Change in heat/lb=34 BTU/lb=36 kJ/lb=79.36 kJ/kg
Required turbine steam usage: 27001b/hr=1224.7 kg/hr=0.340 kg/sec
Steam provided by the collector=3.033 kW/79.36 kJ/kg=0.038 kg/sec

The controller provides a wide range of controls and functionality, such as:

- Solar Panel
- Calibration
- Tracking
  - One Axis
- Shutdown
  - Storms
  - Malfunction
- Turbine Control
- RPM
  - Input and Output Pressures
  - Operational Speed
- Malfunction
- Shutdown
- Log/History
- Transmission Control (optional depending on the turbine/generator specifications)
- Engage
- Disengage
- Malfunction
- Shutdown
- Log/History
- Generator Control
- Speed
- Output
- Temperature
- Shutdown
- Transfer Switch Control
- Input Current
- Output Current
- Status
- Log/History
- System Management
- System Control
- Error Management
- Sub-System—Enable/Disengage
- Remote Access/Phone home
- Heartbeat Monitor
- History

Other control mechanisms, sensors and functionality can be added to the system. Eight solar collector units can occupy a space less than or equal to 700 sqft and provide approximately 14 watts/sqft.

Now referring to FIG. **3**, a block diagram showing the valve and piping layout **300** for a solar energy power generation system **100** in accordance with one embodiment of the present invention is shown. The input hose or pipe **108** connects the outlet **302** of the receiver tube(s) **206** to the fluid/vapor inlet **304** of the fluid/vapor turbine **210**. A temperature and pressure probe or sensor **306** and a first operating pressure modulation valve (2-way) **308** are connected between the outlet **302** of the receiver tube(s) **206** and the fluid/vapor inlet **304** of the fluid/vapor turbine **210**. The fluid/vapor outlet **310** of the fluid/vapor turbine **210** is connected to the pressure vessel **212**. A back flow prevention valve **312** is connected between the fluid/vapor outlet **310** of the fluid/vapor turbine **210** and the pressure vessel **212**. A secondary line **314** connects the pressure vessel **212** to the input hose or pipe **108** between the temperature and pressure probe or sensor **306** and the first operating pressure modulation valve (2-way) **308**. A third operating pressure modulation valve (2-way) **316** on the secondary line **314** is located between the pressure vessel **212** and the input hose or pipe **108**. The output hose or pipe **110** connects the inlet **318** of the receiver tube(s) **206** to the boost pump **220** which is connected to pressure vessel **212**. A second operating pressure modulation valve **320** is connected between the inlet **318** of the receiver tube(s) **206** and the boost pump **220** to control flow into the system and stop the flow in an emergency (Emergency Shutdown). Arrows show the flow of the fluid/vapor. The pressure vessel **212** has a pressure relief valve **310** and may also have other sensors/probes, such as temperature, pressure, fluid level, etc. Temperature and/or pressure sensors/probes can be installed at various monitoring points throughout the system **100**, such as near the receiver tubes **206**, the fluid/vapor turbine **210**, the pressure vessel **212**, etc. The temperature and pressure probe/sensors (e.g., **306**) are communicably coupled to the controller **204**. A RPM sensor (not shown) is attached to the drive shaft **214** and communicably coupled to the controller **204**. In one embodiment, the system **300** operates at approximately 140 PSI.

Referring now to FIG. **4**, a diagram of a solar collector **106** in accordance with one embodiment of the present invention is shown. In this embodiment of the present invention, the reflective parabolic trough **400** is made of aluminum or an aluminum alloy and has an aperture of approximately four feet, a length of approximately 12 feet (not including mounting pylons), a rim angle to approximately 82.5 degrees, a focal length of approximately 1.14 feet and a surface area facing the focal axis of 62.8 square feet. The solar collector **106** is roof mountable and weights approximately 105 pounds. The solar collector **106** includes adjustable brackets **402** and support pylons **404** (see FIG. **9**). Each solar collector **106** has two receiver tubes **206***a* and **206***b* that are approximately six feet long (each). They are mounted to the collector with three adjustable mounting brackets **402**. The brackets **402** allow for three axis of alignment for the receiver tubes **206***a* and **206***b*. The surface of the reflective parabolic trough **400** facing the focal axis is coated with a reflective material.

For example, the curve dimensions of a parabolic reflector **400** in accordance with one embodiment of the present invention can be:

Y (ft)	X (ft)	Y (in)	X (in)	Focal Point (ft)
0.877	2.000	10.526	24	1.14
0.806	1.917	9.667	23	1.14
0.737	1.833	8.845	22	1.14
0.672	1.750	8.059	21	1.14
0.609	1.667	7.310	20	1.14
0.550	1.583	6.597	19	1.14

-continued

Y (ft)	X (ft)	Y (in)	X (in)	Focal Point (ft)
0.493	1.500	5.921	18	1.14
0.440	1.420	5.281	17	1.14
0.390	1.330	4.678	16	1.14
0.343	1.250	4.112	15	1.14
0.298	1.167	3.582	14	1.14
0.257	1.083	3.088	13	1.14
0.219	1.000	2.632	12	1.14
0.184	0.917	2.211	11	1.14
0.152	0.833	1.827	10	1.14
0.123	0.750	1.480	9	1.14
0.097	0.667	1.170	8	1.14
0.075	0.583	0.895	7	1.14
0.055	0.500	0.658	6	1.14
0.038	0.417	0.457	5	1.14
0.024	0.333	0.292	4	1.14
0.014	0.250	0.164	3	1.14
0.006	0.167	0.073	2	1.14
0.002	0.083	0.018	1	1.14
0.000	0.000	0.000	0	1.14
0.002	−0.083	0.018	−1	1.14
0.006	−0.167	0.073	−2	1.14
0.014	−0.250	0.164	−3	1.14
0.024	−0.333	0.282	−4	1.14
0.038	−0.417	0.457	−5	1.14
0.055	−0.500	0.658	−6	1.14
0.075	−0.583	0.895	−7	1.14
0.097	−0.667	1.170	−8	1.14
0.123	−0.750	1.480	−9	1.14
0.152	−0.833	1.827	−10	1.14
0.184	−0.917	2.211	−11	1.14
0.219	−1.000	2.632	−12	1.14
0.257	−1.083	3.088	−13	1.14
0.298	−1.167	3.582	−14	1.14
0.343	−1.250	4.112	−15	1.14
0.390	−1.330	4.678	−16	1.14
0.440	−1.420	5.281	−17	1.14
0.493	−1.500	5.921	−18	1.14
0.550	−1.583	6.597	−19	1.14
0.609	−1.667	7.310	−20	1.14
0.672	−1.750	8.059	−21	1.14
0.737	−1.833	8.845	−22	1.14
0.806	−1.917	9.667	−23	1.14
0.877	−2.000	10.526	−24	1.14

Now referring to FIGS. **5**A and **5**B, diagrams of a solar tracking device or circuit **210** mounted on the reflective parabolic trough **400** in accordance with one embodiment of the present invention are shown. The solar tracking device or circuit **210** includes one or more sensors. In this embodiment, the one or more sensors include three or more photosensitive diodes **500** disposed on the reflective parabolic trough **400** such that when the reflective parabolic through **400** is properly aligned: (a) at least a first of the photosensitive diodes **500***a* is positioned within a center **504** of a shadow **502** cast by the receiver tube(s) **206**, (b) a least a second of the photosensitive diodes **500***b* is positioned within and near a first edge **506** of the shadow **502** cast by the receiver tube(s) **206**, and (c) a least a third of the photosensitive diodes **500***c* is positioned within and near a second edge **508** of the shadow **502** cast by the receiver tube(s) **206**. The solar tracking device **210** can position the solar collector **106** at a previously recorded time-based position whenever the one or more sensors **500** do not provide a position to maximize the solar energy collected by the receiver tube(s) **206**. As a result, the solar tracking device aligns each solar collector to maximize the solar energy collected by the receiver tube(s) regardless of weather conditions.

In other words, to track the sun, one diode **500***a* is placed in the shadow of the receiver tub and two more **500***b* and **500***c* on each edge. The solar tracking device or circuit **210** measures the difference in light intensity measured by the photosensitive diodes **500** and if the diodes in sunlight (e.g., **500***b* or **500***c*) move to the shadow **502**, the tracking motor **209** (e.g., stepper motor) adjusts the position of the reflective parabolic trough **400** to move the diodes (e.g., **500***b* or **500***c*) back into sunlight. If this cannot be achieved within a pre-defined number of steps, the solar tracking device or circuit **210** will position the reflective parabolic trough **400** to a prior days position for the given time slot. As a result, the solar tracking device **210** aligns each solar collector **106** to be in the correct position to maximize the solar energy collected by the receiver tube(s) **206** regardless of weather conditions.

Referring now to FIG. **6**, a diagram of some structural details of a reflective parabolic trough **400** in accordance with one embodiment of the present invention is shown. The structural details of the reflective parabolic trough **400** includes a central support tube **600**, three or more support ribs **602** attached to the central support tube **600** to provide a parabolic shape, a support stringer **604** attached between the support ribs **602** at or near an end of the support ribs **602**, and a metallic sheet (not shown) attached to the support ribs **604** to form the parabolic shape. As shown, the trough is constructed with five support ribs **602** spaced 36 inches apart, six support stringers **604**, and a central support tube **600** on which the reflective parabolic trough **400** rotates. Note that the present invention is not limited to the specific support ribs **602**, support stringers **604**, or spacing shown. The frame is covered with a 20 gauge aluminum skin which the reflective material is bonded to. Other materials and thicknesses can also be used.

Now referring to FIG. **7**, a diagram of a tracking motor assembly **208** for rotating a reflective parabolic trough **400** in accordance with one embodiment of the present invention is shown. As shown in this embodiment of the present invention, the reflective parabolic trough **400** rotation is controlled by a gear box assembly driven by an electric stepper motor. Alternatively, a worm gear assembly can be used. The gear box (or worm gear assembly) and electric stepper motor are mounted to one of the pylons **404**.

Referring now to FIGS. **8**A and **8**B, diagrams of a receiver tube **206** in accordance with one embodiment of the present invention are shown. The receiver tube **206** is an evacuated tube approximately six feet in length with a clamp and gasket style connector **800** extending from each end. The flanged and grooved end facilitates an O-ring and clamp. A threaded connector can also be used. The receiver tube **206** has an exterior layer (transparent tube) **802** that is constructed from borosilicate glass having an outer diameter of approximately 2.3 inches. The inner pipe **804** is a ¾ inch metal pipe (aluminum or an aluminum alloy metal tube) coated with a solar absorption coating applied to the exterior surface of the entire pipe. The inner pipe **804** may or may not have one or more copper heat fins soldered to it. The receiver tube **206** is sealed to the fluid pipe **804** in a manner which allows a vacuum to be applied to the interior space between the exterior layer **802** and the inner pipe **804** thereby creating an evacuated tube. In one embodiment, each end has a ¾ inch NPT threaded end approximately ¾ inch past the formed hex nut. The hex nut is formed or welded to the inner pipe **804**.

Now referring to FIG. **9**, a diagram of a support structure **404** in accordance with one embodiment of the present invention is shown. Each support structure **404** includes a base plate **900** used to secure the solar collector **106** to the surface, a mounting block **902** for connection to the reflective parabolic trough **400**, and a support **904** disposed between the base plate **900** and the mounting block **902**. Note that an angle between the base plate **900** and the surface is adjustable. As shown, each mounting pylori consists of two major parts: (a)

Base Plate **900**; and (b) Mounting pole **904**. The two components (**900** and **904**) are held together with a common bolt (not shown). With respect to the trough mounting block **902**, the hole in the center supports the central support tube **600** and is lined with a Teflon strip which acts as a bearing surface. The central tube **904** is a 1.5 inch round tube approximately 24-26 inches long with bolt holes as the connection point of the two parts. The base plate **900** is used to fasten the collector to the roof or ground. The angle of the plate **900** to the connector (angle "A") is determined by the pitch of the roof or the slope of the ground.

Referring now to FIGS. **10**A-**10**C, various diagrams of the housing or cabinet **200** for some of the components are shown in accordance with one embodiment of the present invention. FIG. **10**A shows an example of the housing or cabinet **200** for the turbine and generator assembly **102** that is weatherproof and suitable for outdoor or attic installation. The housing or cabinet **200** includes the input **108** and output **110** hoses or pipes, the low power cable **112** that goes to the solar collectors **106**, and the power connection **144** that provides the power generated by the generator **216** to the home, building, business, electrical load or utility circuit. The power connection **114** may also include a connection to the user interface **202**.

FIGS. **10**B and **10**C show a 3D perspective view and a side view, respectively, of the turbine and generator assembly **102** in accordance with one embodiment of the present invention. The major components are shown, such as the fluid/vapor turbine **212**, generator **216**, pressure vessel **218**, inlet **108** and outlet **110**, along with the internal bracing, piping, valves, heat exchangers, pumps, and other items. Various circuit boards (collectively the controller **204**) are also shown, such as sun tracker board **1000**, system control board **1002** and motor control board **1004**.

Now referring to FIG. **11**, a block diagram showing the valve and piping layout **300** for a solar energy power generation system **1100** in accordance with another embodiment of the present invention is shown. A first input hose or pipe **108*a*** connects the outlet **302** of the receiver tube(s) **206** to a first operating pressure modulation valve (3-way) **1102**. A first temperature and pressure probe or sensor **306*a*** is connected proximate to the output **302** of the receiver tube(s) **206**, meaning that the temperature and pressure probe or sensor **306*a*** can be integrated into the receiver tube(s) **206**, or attached to the output **302** or attached to the input hose or pipe **108*a***. A second input hose or pipe **108*b*** connects the first operating pressure modulation valve (3-way) **1102** to the fluid/vapor inlet **304** of the fluid/vapor turbine **210**. A second temperature and pressure probe or sensor **306*b*** is connected proximate to the fluid/vapor inlet **304** of the fluid/vapor turbine **210**, meaning that the second temperature and pressure probe or sensor **306*b*** can be integrated into the fluid/vapor turbine **210**, or attached to the fluid/vapor inlet **304** or attached to the input hose or pipe **108*b***. The fluid/vapor outlet **310** of the fluid/vapor turbine **210** is connected to the pressure vessel **212**. A first pressure probe **1104*a*** is connected between the fluid/vapor outlet **310** of the fluid/vapor turbine **210** and the pressure vessel **212**. Alternatively, the first pressure probe **1104** can be integrated into the fluid/vapor turbine **210** or the pressure vessel **212**. A secondary line **314** connects the pressure vessel **212** to the first operating pressure modulation valve (3-way) **1102**. A second pressure probe **1104*b*** on the secondary line **314** is located between the pressure vessel **212** and the first operating pressure modulation valve (3-way) **1102**. Alternatively, the second pressure probe **1104*b*** can be integrated into or connected directly to the pressure vessel **212** or connected directly to the first operating pressure modulation valve (3-way) **1102**. A boost pump **220** is connected in parallel with an anti-siphon valve **1106**, both of which are connected to the pressure vessel **212** with a first output hose or pipe **110*a***, and to a second operating pressure modulation valve (2-way) **320** with a second output hose or pipe **110*b***. The second operating pressure modulation valve **320** controls flow into the system and stops the flow in an emergency (Emergency Shutdown). A third output hose or pipe **110*c*** connects the inlet **318** of the receiver tube(s) **206** to the second operating pressure modulation valve (2-way) **320**. A temperature probe or sensor **1108** is connected proximate to the input **318** of the receiver tube(s) **206**, meaning that the temperature probe or sensor **1108** can be integrated into the receiver tube(s) **206**, or attached to the input **318** or attached to the third output hose or pipe **108*c***. Arrows show the flow of the fluid/vapor. The pressure vessel **212** has a pressure relief valve **310** and may also have other sensors/probes, such as temperature, pressure, fluid level **1110**, etc. Additional temperature and/or pressure sensors/probes can be installed at various monitoring points throughout the system **1100**. The temperature and/or pressure probe/sensors (e.g., **306**, **1104**, **1108**, etc.) are communicably coupled to the controller **204**. A RPM sensor **1112** is attached to the drive shaft **214** and communicably coupled to the controller **204**. In one embodiment, the system **1100** operates at approximately 140 PSI.

A bladeless turbine, such as fluid/vapor turbine **212**, in accordance with one embodiment of the present invention will now be described in reference to FIGS. **12**-**15**. This design is provided as an example of a suitable fluid/vapor turbine **212** for the solar power generation system previously described. The bladeless turbine described in FIGS. **12**-**15** is not limited to use in solar energy systems and can be used in many types of systems, such as biomass combustion, geothermal heat, industrial waste heat recovery (e.g., recovering heat from oil field flaring), and other "green" or semi-"green" systems. Moreover, the bladeless turbine can be used with water, steam, hydrocarbons and refrigerants. As will be appreciated by those skilled in the art, the bladeless turbine in accordance with the present invention is not limited to those systems specifically mentioned or described herein. Finally, any details or components not shown in FIGS. **12**-**15** that are required to replicate the fluid/vapor turbine in accordance with the present invention will be well known or apparent to those skilled in the art in light of the following FIGURES and description, and are not necessary for a complete understanding of the inventive aspects of the bladeless turbine.

More specifically, FIGS. **12**A, **12**B and **12**C are diagrams showing various views and details of a turbine case **1200** for the bladeless turbine in accordance with one embodiment of the present invention. FIGS. **13**A, **13**B and **13**C are diagrams of the front, intermediate and rear discs, respectively, for the bladeless turbine in accordance with one embodiment of the present invention. FIGS. **14**A and **14**B are diagrams of an inlet nozzle and a gasket in accordance with one embodiment of the present invention. FIG. **15** is a diagram of a turbine/generator common shaft in accordance with one embodiment of the present invention.

The turbine case **1200** is a metal housing having a main housing **1202** (FIG. **12**A), a cover **1204** (FIG. **12**B) and a gasket **1206** (FIG. **12**C) disposed between the main housing **1202** (also called a shell) and the cover **1204** (also called a lid). The turbine case **1200** surrounds and completely encases the turbine discs **1300** (FIG. **13**A), **1302** (FIG. **13**B) and **1304** (FIG. **13**C). The turbine case **1200** is designed to contain the flow of fluids and gases from the inlet nozzle **1400** (FIG. **14**A), around, over, and through the turbine discs **1300** (FIG. **13**A), **1302** (FIG. **13**B) and **1304** (FIG. **13**C) to the exhaust port **1222**. Additionally, integral to the turbine case **1200** is the ability to mount the bladeless to a frame, housing, or other fixture. Part of the case design is the labyrinth seal which prevents the gases from escaping from between the center rotating shaft **1500** (FIG. **15**) and the case **1200** itself. More specifically and will be apparent from the description below, the labyrinth seal is formed by shape and positioning of the turbine discs, the main housing, the case and the drive shaft. The turbine case **1200** can be easily manufactured at high volume and low cost. No additional seals are needed or exterior mounting fixtures to hold the turbine to a frame or fixture. Due to its compact size (longer horizontal axis for the same overall surface area) when compared to other turbine disc designs, it can fit into a relatively small space.

As shown in FIG. **12**A, the main housing **1202** includes an annular cavity **1208** in which the turbine discs **1300** (rear), **1302** (intermediate) and **1304** (front) are free to rotate, one or more holes **1210** to accommodate a fixed nozzle **1500**, and a center through hole **1212** for the drive end **1502** of the shaft **1500** to extend through for connection to the generator **216**. As shown, the main housing **1202** includes two holes **1212***a* and **1212***b* oriented on opposite sides of the main housing **1202**. The radius (e.g., 3.665 in) of the annular cavity **1208** is slightly larger than the radius (e.g., 3.625 in) of the turbine discs **1300**, **1302** and **1304**. The bottom of the annular cavity **1214** includes a first annular recess **1216** to receive a portion **1312** of the rear disc **1300**, and a second annular recess **1218** to receive a ridge **1508** on the annular disc stop **1506** of the shaft **1500**. The second annular recess **1218** also includes an annular groove **1220** to receive an annular ridge or ring **1508** on the annular disc stop **1506** of the shaft **1500**. The first annular recess **1216** has a slightly smaller radius (e.g., 3.540 in) than the radius (e.g., 3.665 in) the annular cavity **1208**. The second annular recess **1218** has a slightly larger radius (e.g., 0.968 in) than the radius (e.g., 0.9375 in) of the annular disc stop **1506** of the shaft **1500**.

As shown in FIG. **12**B, the cover **1204** includes an exhaust outlet (threaded hole) **1222** for connection to the hoses or pipes that lead to the pressure vessel **218**, a set of exhaust holes **1224** positioned proximate to the perimeter of the exhaust outlet **1222**, and a recess or opening **1226** for the exhaust end **1504** of the shaft **1500**. As shown, the set of exhaust holes **1224** comprise eight ellipse-shaped or oval-shaped holes equally spaced around the shaft **1500** at a fixed distance from the centerline **1228** of the housing **1200**. The cover **1204** also includes a first annular recess **1230** to receive a portion of the front disc **1304**, and a second annular recess **1232** to receive an annular ridge or ring **1330** on the front disc **1304**. The first annular recess **1230** has a slightly smaller radius (e.g., 3.540 in) than the radius (e.g., 3.665 in) the annular cavity **1214**. The second annular recess **1232** has a slightly larger radius (e.g., 0.1.360 in) than the radius (e.g., 1.320 in) of the annular ridge or ring **1330** on the front disc **1304**. A portion of the cover **1234** extends into the annular cavity **1214** and the cover **1204** is affixed to the main housing **1202** using standard hardware and gasket **1206**.

As shown in FIG. **13**A, the rear disc **1300** includes an opening **1306** for the shaft **1500**, a set of middle holes **1308** positioned annularly around the opening **1306**, a set of outer holes **1310** positioned annularly around the opening **1306**, a smaller diameter portion **1312**, and a raised annular portion **1314** around the opening **1306**. The opening **1306** includes a keyway **1316** for rotationally securing the rear disc **1300** to the shaft **1500**. As shown, the set of middle holes **1308** comprises twelve holes equally spaced approximately thirty degrees (30°) from one another within a middle portion of the rear disc **1300** (e.g., at a radius of 2.003 in from the centerline **1228**), and the set of outer holes **1310** comprises twelve holes equally spaced approximately thirty degrees (30°) from one another proximate to a perimeter of the rear disc **1300** (e.g., at a radius of about 3.344 in from the centerline **1228**). Note that a different number, sizing and spacing (e.g., 15° to) 60° can be used. The smaller diameter portion **1312** fits into the first annular recess **1216** of the main housing **1202**. The raised annular portion **1314** contacts the disc stop **1506** of the shaft **1500**.

As shown in FIG. **13**B, the intermediate disc **1302** includes an opening **1306** for the shaft **1500**, a set of exhaust ports **1318** positioned annularly around the opening **1306**, and a set of middle holes **1320** positioned annularly around the opening **1306**, a set of outer holes **1322** positioned annularly around the opening **1306**. The opening **1306** includes a keyway **1316** for rotationally securing the rear disc **1300** to the shaft **1500**. As shown, the set of middle holes **1320** comprises twelve holes equally spaced approximately thirty degrees (30°) from one another within a middle portion of the intermediate disc **1302** (e.g., at a radius of 2.003 in from the centerline **1228**), and the set of outer holes **1322** comprises twelve holes equally spaced approximately thirty degrees (30°) from one another proximate to a perimeter of the intermediate disc **1302** (e.g., at a radius of about 3.344 in from the centerline **1228**). Note that a different number, sizing and spacing (e.g., 15° to 60°) can be used. The set of exhaust ports **1318** comprise eight ellipse-shaped or oval-shaped holes offset from one another by approximately forty-five degrees (45°) at a equal distance (e.g., 0.969 in) from the centerline **1228**. The first exhaust port **1318***a* is offset from the keyway **1316** by approximately twenty-two and one-half degrees (22.5°). Note that a different number, offset (e.g., 15° to 30°), sizing and spacing (e.g., 30° to 60°) can be used. The pattern, size, and location of the discs in relationship to the turbine shaft **1500** is aerodynamically designed to create a turbulent free flow of exhaust gases from the turbine discs **1300**, **1302** and **1304** to the exhaust pipe. The design has a higher flow rate and therefore is less restrictive than other designs. This design (better flow rate) facilities the turbine having a higher adiabatic efficiency. Note that more than one intermediate disc **1302** can be used.

As shown in FIG. **13**C, the front disc **1304** includes an opening **1306** for the shaft **1500**, a set of middle holes **1324** positioned annularly around the opening **1306**, a set of outer holes **1326** positioned annularly around the opening **1306**, a smaller diameter portion **1328**, and a raised annular ridge or ring **1330** around the opening **1306**. The opening **1306** includes a keyway **1316** for rotationally securing the rear disc **1300** to the shaft **1500**. As shown, the set of middle holes **1324** comprises twelve holes equally spaced approximately thirty degrees (30°) from one another within a middle portion of the front disc **1304** (e.g., at a radius of 2.003 in from the centerline **1228**), and the set of outer holes **1326** comprises twelve holes equally spaced approximately thirty degrees (30°) from one another proximate to a perimeter of the front disc **1304** (e.g., at a radius of about 3.344 in from the centerline **1228**). Note that a different number, sizing and spacing (e.g., 15° to) 60° can be used. The smaller diameter portion **1328** fits into the first annular recess **1230** of the cover **1204**. The raised annular ridge or ring **1330** fits into the second annular recess **1232** of the cover **1204**. The set of exhaust ports **1318** comprise eight ellipse-shaped or oval-shaped holes offset from one another by approximately forty-five degrees (45°) at a equal distance (e.g., 0.969 in) from the centerline **1228**. The first exhaust port **1318***a* is offset from the keyway **1316** by approximately twenty-two and one-half degrees (22.5°). Note that a different number, offset (e.g., 15° to 30°), sizing and spacing (e.g., 30° to 60°) can be used. The pattern, size, and location of the turbine discs in relationship to the turbine shaft **1500** is aerodynamically designed to create a turbulent free flow of exhaust gases from the turbine discs **1300**, **1302** and **1304** to the exhaust pipe. The design has a higher flow rate and therefore is less restrictive than other designs. This design (better flow rate) facilities the turbine having a higher adiabatic efficiency.

As shown in FIG. **14**A, the inlet nozzle **1400** is the pattern, shape and size of the cavity created within the block of material (metal or ceramic) where the inlet pipe connects on one end **1402** of the block and the opposite end **1404** is mounted to the turbine case **1202**. The inlet nozzle controls the pattern, pressure, and distribution of the fluid and vapor across the turbine discs **1300**, **1302** and **1304**. This design is optimized for the flow of two phase steam when used with a turbine disc design. This optimal shape allows the turbine to operate at peak performance. When combined with the high flow rate exhaust design, the disc based turbine efficiencies can be equal to or greater than 50% (preferably in excess of 65%) when compared to 18%-20% of other disc based turbine designs. As shown, the inlet nozzle jet **1406** is aligned at a tangent of approximately fifty-two and one-half degrees (52.5°) and comprises a wedge-shaped slit **1408** having an angle of approximately forty degrees (e.g., 39.861°) that opens into the annular cavity **1208** parallel to the centerline **1228**. Other alignments (e.g., 50° to 55°) and angles can be used. FIG. **14**B shows the gasket **1402** used to mount the insert portion **1410** and O-ring of the inlet nozzle **1400** in the hole **1210** in the main casing **1202**.

As shown in FIG. **15**, the turbine and generator common shaft **1500** is a single rotational shaft supporting both the rotating discs **1300**, **1302** and **1304** in the fluid/vapor turbine **212** and the rotating parts of a switch reluctance generator **216**. The exhaust end **1504** of the shaft **1500** is supported by a bearing (not shown) located in the turbine case **1200**. The drive end **1502** of the shaft **1500** is supported by a bearing (not shown) located in the generator case **216**. Designed on the shaft is the labyrinth seal used on both the turbine **1200** and generator **216** cases. By using a single shaft **1500** for both a turbine **212** and generator **216** assembly, the total numbers of parts are reduced. No interim connection shaft or coupling is required and the total number of bearings is reduced from four to two. Additionally the over-all space required is reduced. As previously described, the shaft **1500** includes a keyway **1510**, an annular disc stop **1506** and an annular ridge or ring **1508** on the annular disc stop **1506**.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, machine, manufacture, composition of matter, means, methods and steps described in the specification, but only by the claims.

The invention claimed is:

1. A bladeless turbine comprising:

a case comprising a main housing, a cover and a centerline;

three or more turbine discs disposed within the case, wherein each turbine disc has a center opening, a first set of holes substantially equally spaced from one another along a first radius from the centerline, a second set of holes substantially equally spaced from one another along a second radius from the centerline, and two or more of the turbine discs have a set of exhaust ports positioned annularly around the center opening;

a drive shaft passing through the center openings of the three or more turbine discs and attached to the three or more turbine discs, wherein the drive shaft is positioned within the case along the centerline, free to rotate within the case, and extends through the main housing for connection to a generator;

one or more fluid/vapor inlets attached to the main housing such that a fluid/vapor is directed at a specified angle onto the three or more turbine discs;

a fluid/vapor outlet in the cover and aligned with the centerline;

a set of exhaust holes proximate to and connected to the fluid/vapor outlet that are positioned annularly around the drive shaft; and

wherein the fluid/vapor causes the turbine discs to rotate, passes through the set of exhaust ports and the set of exhaust holes, and exits through the fluid/vapor outlet.

2. The bladeless turbine as recited in claim **1**, wherein the set of exhaust ports and the set of exhaust holes are ellipse-shaped or oval-shaped.

3. The bladeless turbine as recited in claim **1**, further comprising a first gasket between the main housing and the cover, a second gasket between each fluid/vapor inlet and the main housing, and a labyrinth seal formed by shape and positioning of the turbine discs, the main housing, the case and the drive shaft.

4. The bladeless turbine as recited in claim **1**, wherein each fluid/vapor inlet comprises a wedge-shaped jet, the specified angle is between 50 and 55 degrees, and the wedge-shaped jet has an angle of approximately 40 degrees.

5. The bladeless turbine as recited in claim **1**, wherein the fluid/vapor comprises water, steam, a hydrocarbon or a refrigerant.

6. The bladeless turbine as recited in claim **1**, wherein the first radius is within a middle portion of the turbine disc, the second radius is proximate to a perimeter of the turbine disc, and the holes are spaced approximately 30 degrees from one another.

7. The bladeless turbine as recited in claim **1**, wherein the drive shaft is a common shaft used by both the bladeless turbine and a generator or a machine.

8. The bladeless turbine as recited in claim **7**, wherein only a first bearing located in the bladeless turbine and a second bearing is located in the generator or the machine are used to support the drive shaft.

9. The bladeless turbine as recited in claim **1**, wherein the bladeless turbine has an efficiency equal to or greater than 50%.

10. The bladeless turbine as recited in claim **1**, wherein:

the center opening includes a keyway for rotationally securing each turbine disc to the drive shaft;

the first set of holes comprise a set of twelve middle holes substantially equally spaced approximately thirty degrees from one another along the first radius from the centerline, wherein the first radius is within a middle portion of each turbine disc;

the second set of holes comprise a set of twelve outer holes substantially equally spaced approximately thirty degrees from one another along the second radius from the centerline, wherein the second radius is proximate to a perimeter of each turbine disc

each set of exhaust ports comprise eight ellipse-shaped or oval-shaped holes offset from one another by approximately forty-five degrees at a equal distance from the centerline;

the three or more turbine discs comprise a rear disc, one or more intermediate discs and a front disc;

the rear disc includes a smaller diameter portion that fits into a first annular recess of the main housing, and a raised annular portion around the center opening for the drive shaft that fits into the first annular recess of the main housing;

the one or more intermediate discs includes the set of exhaust ports positioned annularly around the center opening;

the front disc includes the set of exhaust ports positioned annularly around the center opening, a smaller diameter portion that fits into a first annular recess of the cover, and a raised annular ridge or ring around the opening that fits into a second annular recess of the cover.

11. The bladeless turbine as recited in claim **1**, wherein each fluid/vapor inlet comprises an inlet nozzle aligned at the specified angle having a tangent of approximately fifty-two and one-half degrees and having a wedge-shaped slit having an angle of approximately forty degrees that opens into an annular cavity parallel to the centerline.

12. The bladeless turbine as recited in claim **1**, wherein:

the main housing comprises an annular cavity in which the one or more turbine discs are free to rotate, one or more holes to accommodate a fixed nozzle, a center through hole for a drive end of the drive shaft to extend through, and two holes oriented on opposite sides of the main housing, wherein a bottom of the annular cavity includes a first annular recess to receive a portion of one of the three or more turbine discs, and a second annular recess to receive a ridge on an annular disc stop of the drive shaft and an annular groove to receive an annular ridge or ring on the annular disc stop of the drive shaft;

the cover having an exhaust outlet, a set of eight ellipse-shaped or oval-shaped exhaust holes positioned proximate to a perimeter of the exhaust outlet and equally spaced around the drive shaft at a fixed distance from the centerline, a recess or opening for an exhaust end of the drive shaft, a first annular recess to receive a portion of one of the three or more turbine discs, a second annular recess to receive an annular ridge or ring one of the three or more turbine discs, and wherein a portion of the cover extends into the annular cavity and the cover is affixed to the main housing; and

the drive shaft comprises a single rotational shaft supporting the three or more turbine discs, and includes a keyway, the annular disc stop, and the annular ridge or ring on the annular disc stop.

13. The bladeless turbine as recited in claim **1**, wherein the turbine is used in a solar energy system, a biomass combustion system, a geothermal heat system or an industrial waste heat recovery system.

14. A solar power system comprising:

one or more solar collectors, each solar collector comprising (a) one or more support structures for securely mounting the solar collector to a surface, (b) a reflective parabolic trough for concentrating solar energy along a focal axis and attached to the support structure(s) to allow rotation of the reflective parabolic trough around a longitudinal axis, (c) one or more receiver tubes attached to the reflective parabolic trough along the focal axis, wherein each receiver tube comprises (i) a metal tube having an inlet, an outlet and a solar absorption coating, and (ii) a transparent tube having a first seal and a second seal to vacuum or hermetically seal the metal tube between approximately the inlet and the outlet within the transparent tube, and (d) a motor operably connected to the reflective parabolic trough to rotate the reflective parabolic trough around the longitudinal axis;

a solar tracking device having one or more sensors to control the motor to align each solar collector to maximize the solar energy collected by the one or more receiver tubes;

a bladeless fluid/vapor turbine having a drive shaft, one or more fluid/vapor inlets connected to the outlet of the receiver tube(s) and a fluid/vapor outlet connected to the inlet of the receiver tube(s), wherein the bladeless fluid/vapor turbine comprises: (a) a case comprising a main housing, a cover and a centerline, (b) three or more turbine discs disposed within the case, wherein each turbine disc has a center opening, and two or more of the turbine discs have a set of exhaust ports positioned annularly around the center opening, (c) the drive shaft passes through the center openings of the three or more turbine discs and is attached to the three or more turbine discs, wherein the drive shaft is positioned within the case along the centerline, free to rotate within the case, and extends through the main housing for connection to a generator, (d) the one or more fluid/vapor inlets are attached to the main housing such that a fluid/vapor is directed at a specified angle onto the three or more turbine discs, (e) the fluid/vapor outlet is disposed in the cover and aligned with the centerline, (f) a set of exhaust holes proximate to and connected to the fluid/vapor outlet that are positioned annularly around the drive shaft, and (g) wherein the fluid/vapor causes the turbine discs to rotate, passes through the set of exhaust ports and the set of exhaust holes, and exits through the fluid/vapor outlet;

the generator connected to the drive shaft of the fluid/vapor turbine and having one or more electrical output terminals; and

a controller connected to the motor, the solar tracking device, the fluid/vapor turbine and the generator to monitor and control the system.

15. The solar power system as recited in claim **14**, wherein the one or more sensors of the solar tracking device comprises three or more photosensitive diodes disposed on the reflective parabolic trough such that when the reflective parabolic through is properly aligned: at least a first of the photosensitive diodes is positioned within a center of a shadow cast by the receiver tube(s), a least a second of the photosensitive diodes is positioned within and near a first edge of the shadow cast by the receiver tube(s), and a least a third of the photosensitive diodes is positioned within and near a second edge of the shadow cast by the receiver tube(s).

16. The solar power system as recited in claim **14**, wherein the solar tracking device will position the solar collector at a previously recorded time-based position whenever the one or more sensors do not provide a position to maximize the solar energy collected by the receiver tube(s).

17. The solar power system as recited in claim **14**, wherein the solar tracking device aligns each solar collector to maximize the solar energy collected by the receiver tube(s) regardless of weather conditions.

18. The solar power system as recited in claim **14**, wherein the controller positions each solar collector to minimize damage in potentially damaging weather.

19. The solar power system as recited in claim **14**, further comprising a user interface installed on a user device communicably coupled to the controller.

20. The solar power system as recited in claim **19**, wherein:

the user device comprises a computer, a laptop, a PDA, a phone, a mobile communications device or other electronic device; and the user device is communicably coupled to the controller via a direct connection, a network connection, a USB connection, a wireless network, a wide area network or a combination thereof.

21. The solar power system as recited in claim **14**, further comprising:

a pressure vessel connected between the inlet of the receiver tube(s) and the fluid/vapor outlet of the fluid/vapor turbine;

a first operating pressure modulation valve and a temperature/pressure sensor connected between the outlet of the receiver tube(s) and the fluid/vapor inlet of the fluid/vapor turbine; and

a second operating pressure modulation valve connected between the pressure vessel and the inlet of the receiver tube(s).

22. The solar power system as recited in claim **21**, further comprising a primerboost pump connected between the pressure vessel and the second operating pressure modulation valve.

23. The solar power system as recited in claim **21**, further comprising:

a secondary line connecting the pressure vessel to a hose or pipe between the outlet of the receiver tube(s) and the first operating pressure modulation valve;

a third operating pressure modulation valve disposed in the secondary line; and

a back flow prevention valve connected between the fluid/vapor outlet of the fluid/vapor turbine and the pressure vessel.

24. The solar power system as recited in claim **21**, further comprising:

a pressure relief valve attached to the pressure vessel;

a fluid level sensor attached to the pressure vessel and communicably coupled to the controller;

one or more additional temperature sensor and/or pressure sensors attached at various points in the system;

one or more heat exchangers attached within the system; and

a RPM sensor attached to the drive shaft and communicably coupled to the controller.

25. The solar power system as recited in claim **14**, wherein the set of exhaust ports and the set of exhaust holes are ellipse-shaped or oval-shaped.

26. The solar power system as recited in claim **14**, further comprising a first gasket between the main housing and the cover, a second gasket between each fluid/vapor inlet and the main housing, and a labyrinth seal formed by shape and positioning of the turbine discs, the main housing, the case and the drive shaft.

27. The solar power system as recited in claim **14**, wherein each fluid/vapor inlet comprises a wedge-shaped jet, the specified angle is between 50 and 55degrees, and the wedge-shaped jet has an angle of approximately 40 degrees.

28. The solar power system as recited in claim **14**, wherein the fluid/vapor comprises water, steam, a hydrocarbon or a refrigerant.

29. The solar power system as recited in claim **14**, wherein each of the turbine discs further comprise:

a first set of holes substantially equally spaced from one another along a first radius from the centerline; and

a second set of holes substantially equally spaced from one another along a second radius from the centerline.

30. The solar power system as recited in claim **29**, wherein the first radius is within a middle portion of the turbine disc, the second radius is proximate to a perimeter of the turbine disc, and the holes are spaced approximately 30 degrees from one another.

31. The solar power system as recited in claim **14**, wherein the drive shaft is a common shaft used by both the bladeless turbine and a generator or a machine.

32. The solar power system as recited in claim **31**, wherein only a first bearing located in the bladeless turbine and a second bearing is located in the generator or the machine are used to support the drive shaft.

33. The solar power system as recited in claim **14**, wherein the bladeless turbine has an efficiency equal to or greater than 50%.

34. The solar power system as recited in claim **14**, wherein:

the center opening includes a keyway for rotationally securing each turbine disc to the drive shaft;

the first set of holes comprise a set of twelve middle holes substantially equally spaced approximately thirty degrees from one another along the first radius from the centerline, wherein the first radius is within a middle portion of each turbine disc;

the second set of holes comprise a set of twelve outer holes substantially equally spaced approximately thirty degrees from one another along the second radius from the centerline, wherein the second radius is proximate to a perimeter of each turbine disc

each set of exhaust ports comprise eight ellipse-shaped or oval-shaped holes offset from one another by approximately forty-five degrees at a equal distance from the centerline;

the three or more turbine discs comprise a rear disc, one or more intermediate discs and a front disc;

the rear disc includes a smaller diameter portion that fits into a first annular recess of the main housing, and a raised annular portion around the center opening for the drive shaft that fits into the first annular recess of the main housing;

the one or more intermediate discs includes the set of exhaust ports positioned annularly around the center opening;

the front disc includes the set of exhaust ports positioned annularly around the center opening, a smaller diameter portion that fits into a first annular recess of the cover, and a raised annular ridge or ring around the opening that fits into a second annular recess of the cover.

35. The solar power system as recited in claim **14**, wherein each fluid/vapor inlet comprises an inlet comprise an inlet nozzle aligned at the specified angle having a tangent of approximately fifty-two and one-half degrees and having a wedge-shaped slit having an angle of approximately forty degrees that opens into an annular cavity parallel to the centerline.

36. The solar power system as recited in claim **14**, wherein:

the main housing comprises an annular cavity in which the one or more turbine discs are free to rotate, one or more holes to accommodate a fixed nozzle, a center through hole for a drive end of the drive shaft to extend through, and two holes oriented on opposite sides of the main housing, wherein a bottom of the annular cavity includes a first annular recess to receive a portion of one of the three or more turbine discs, and a second annular recess to receive a ridge on an annular disc stop of the drive shaft and an annular groove to receive an annular ridge or ring on the annular disc stop of the drive shaft;

the cover having an exhaust outlet, a set of eight ellipse-shaped or oval-shaped exhaust holes positioned proximate to a perimeter of the exhaust outlet and equally spaced around the drive shaft at a fixed distance from the centerline, a recess or opening for an exhaust end of the drive shaft, a first annular recess to receive a portion of one of the three or more turbine discs, a second annular recess to receive an annular ridge or ring one of the three or more turbine discs, and wherein a portion of the cover extends into the annular cavity and the cover is affixed to the main housing; and

the drive shaft comprises a single rotational shaft supporting the three or more turbine discs, and includes a keyway, the annular disc stop, and the annular ridge or ring on the annular disc stop.

37. A solar power system comprising:

one or more solar collectors, each solar collector comprising (a) one or more support structures for securely mounting the solar collector to a surface, (b) a reflective parabolic trough for concentrating solar energy along a focal axis and attached to the support structure(s) to allow rotation of the reflective parabolic trough around a longitudinal axis, (c) one or more receiver tubes attached to the reflective parabolic trough along the focal axis, wherein each receiver tube comprises (i) a metal tube having an inlet, an outlet and a solar absorption coating, and (ii) a transparent tube having a first seal and a second seal to vacuum or hermetically seal the metal tube between approximately the inlet and the outlet within the transparent tube, and (d) a motor operably connected to the reflective parabolic trough to rotate the reflective parabolic trough around the longitudinal axis;

a solar tracking device having one or more sensors to control the motor to align each solar collector to maximize the solar energy collected by the one or more receiver tubes, wherein the sensors comprise three or more photosensitive diodes disposed on the reflective parabolic trough such that when the reflective parabolic through is properly aligned: at least a first of the photosensitive diodes is positioned within a center of a shadow cast by the receiver tube(s), a least a second of the photosensitive diodes is positioned within and near a first edge of the shadow cast by the receiver tube(s), and a least a third of the photosensitive diodes is positioned within and near a second edge of the shadow cast by the receiver tube(s);

a bladeless fluid/vapor turbine having a drive shaft, one or more fluid/vapor inlets and a fluid/vapor outlet, wherein the bladeless fluid/vapor turbine comprises: (a) a case comprising a main housing, a cover and a centerline, (b) three or more turbine discs disposed within the case, wherein each turbine disc has a center opening, and two or more of the turbine discs have a set of exhaust ports positioned annularly around the center opening, (c) the drive shaft passes through the center openings of the three or more turbine discs and is attached to the three or more turbine discs, wherein the drive shaft is positioned within the case along the centerline, free to rotate within the case, and extends through the main housing for connection to a generator, (d) the one or more fluid/vapor inlets are attached to the main housing such that a fluid/vapor is directed at a specified angle onto the three or more turbine discs, (e) the fluid/vapor outlet is disposed in the cover and aligned with the centerline, (f) a set of exhaust holes proximate to and connected to the fluid/vapor outlet that are positioned annularly around the drive shaft, and (g) wherein the fluid/vapor causes the turbine discs to rotate, passes through the set of exhaust ports and the set of exhaust holes, and exits through the fluid/vapor outlet;

the generator connected to the drive shaft of the fluid/vapor turbine and having one or more electrical output terminals;

a first operating pressure modulation valve and a temperature/pressure sensor connected between the outlet of the receiver tube(s) and the fluid/vapor inlet of the fluid/vapor turbine;

a back flow prevention valve connected to the fluid/vapor outlet of the fluid/vapor turbine;

a pressure vessel connected to the back flow prevention valve;

a secondary line connecting the pressure vessel to a hose or pipe between the outlet of the receiver tube(s) and the first operating pressure modulation valve;

a third operating pressure modulation valve disposed in the secondary line;

a primer/boost pump connected to the pressure vessel

a second operating pressure modulation valve connected between the primer/boost pump and the inlet of the receiver tube(s); and

a controller connected to the motor, the solar tracking device, the fluid/vapor turbine and the generator to monitor and control the system.

38. The solar power system as recited in claim **37**, wherein the solar tracking device will position the solar collector at a previously recorded time-based position whenever the one or more sensors do not provide a position to maximize the solar energy collected by the receiver tube(s).

39. The solar power system as recited in claim **37**, wherein:

the solar tracking device aligns each solar collector to maximize the solar energy collected by the receiver tube(s) regardless of weather conditions; and

the controller positions each solar collector to minimize damage in potentially damaging weather.

40. The solar power system as recited in claim **37**, wherein the set of exhaust ports and the set of exhaust holes are ellipse-shaped or oval-shaped.

41. The solar power system as recited in claim **37**, further comprising a first gasket between the main housing and the cover, a second gasket between each fluid/vapor inlet and the main housing, and a labyrinth seal formed by shape and positioning of the turbine discs, the main housing, the case and the drive shaft.

42. The solar power system as recited in claim **37**, wherein each fluid/vapor inlet comprises a wedge-shaped jet, the specified angle is between 50 and 55 degrees, and the wedge-shaped jet has an angle of approximately 40 degrees.

43. The solar power system as recited in claim **37**, wherein the fluid/vapor comprises water, steam, a hydrocarbon or a refrigerant.

44. The solar power system as recited in claim **37**, wherein each of the turbine discs further comprise:

a first set of holes substantially equally spaced from one another along a first radius from the centerline; and

a second set of holes substantially equally spaced from one another along a second radius from the centerline.

45. The solar power system as recited in claim **44**, wherein the first radius is within a middle portion of the turbine disc, the second radius is proximate to a perimeter of the turbine disc, and the holes are spaced approximately 30 degrees from one another.

46. The solar power system as recited in claim **37**, wherein the drive shaft is a common shaft used by both the bladeless turbine and a generator or a machine.

47. The solar power system as recited in claim **46**, wherein only a first bearing located in the bladeless turbine and a second bearing is located in the generator or the machine are used to support the drive shaft.

48. The solar power system as recited in claim **37**, wherein the bladeless turbine has an efficiency equal to or greater than 50%.

49. The solar power system as recited in claim **37**, wherein:

the center opening includes a keyway for rotationally securing each turbine disc to the drive shaft;

the first set of holes comprise a set of twelve middle holes substantially equally spaced approximately thirty degrees from one another along the first radius from the centerline, wherein the first radius is within a middle portion of each turbine disc;

the second set of holes comprise a set of twelve outer holes substantially equally spaced approximately thirty degrees from one another along the second radius from the centerline, wherein the second radius is proximate to a perimeter of each turbine disc

each set of exhaust ports comprise eight ellipse-shaped or oval-shaped holes offset from one another by approximately forty-five degrees at a equal distance from the centerline;

the three or more turbine discs comprise a rear disc, one or more intermediate discs and a front disc;

the rear disc includes a smaller diameter portion that fits into a first annular recess of the main housing, and a raised annular portion around the center opening for the drive shaft that fits into the first annular recess of the main housing;

the one or more intermediate discs includes the set of exhaust ports positioned annularly around the center opening;

the front disc includes the set of exhaust ports positioned annularly around the center opening, a smaller diameter portion that fits into a first annular recess of the cover, and a raised annular ridge or ring around the opening that fits into a second annular recess of the cover.

50. The solar power system as recited in claim **37**, wherein each fluid/vapor inlet comprises an inlet nozzle aligned at the specified angle having a tangent of approximately fifty-two and one-half degrees and having a wedge-shaped slit having an angle of approximately forty degrees that opens into an annular cavity parallel to the centerline.

51. The solar power system as recited in claim **37**, wherein:

the main housing, comprises an annular cavity in which the one or more turbine discs are free to rotate, one or more holes to accommodate a fixed nozzle, a center through hole for a drive end of the drive shaft to extend through, and two holes oriented on opposite sides of the main housing, wherein a bottom of the annular cavity includes a first annular recess to receive a portion of one of the three or more turbine discs, and a second annular recess to receive a ridge on an annular disc stop of the drive shaft and an annular groove to receive an annular ridge or ring on the annular disc stop of the drive shaft;

the cover having an exhaust outlet, a set of eight ellipse-shaped or oval-shaped exhaust holes positioned proximate to a perimeter of the exhaust outlet and equally spaced around the drive shaft at a fixed distance from the centerline, a recess or opening for an exhaust end of the drive shaft, a first annular recess to receive a portion of one of the three or more turbine discs, a second annular recess to receive an annular ridge or ring one of the three or more turbine discs, and wherein a portion of the cover extends into the annular cavity and the cover is affixed to the main housing; and

the drive shaft comprises a single rotational shaft supporting the three or more turbine discs, and includes a keyway, the annular disc stop, and the annular ridge or ring on the annular disc stop.

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